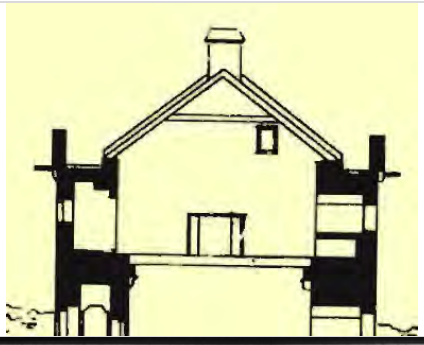
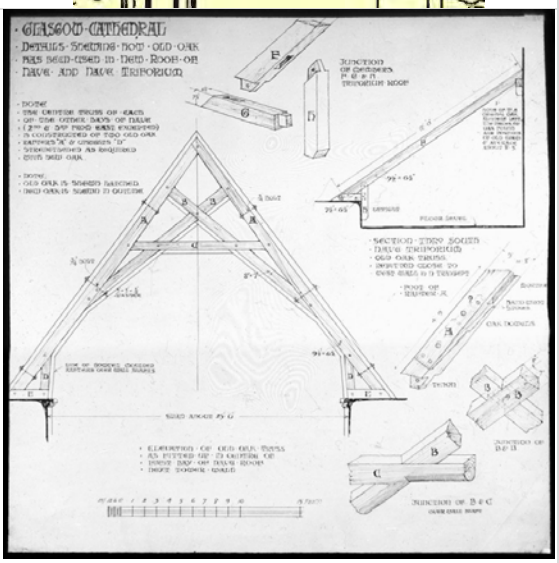
VOLUME 2

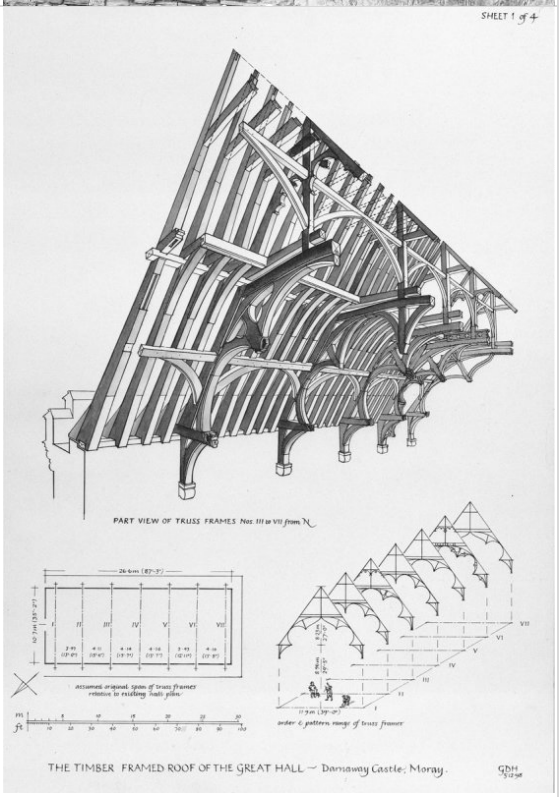
APPENDIX A

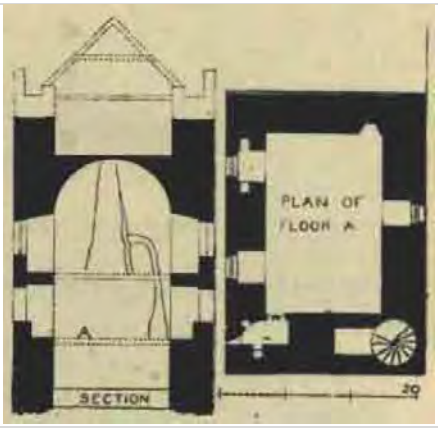
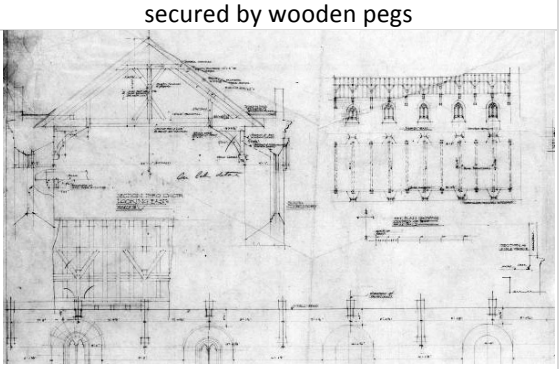
INFORMATION ON PRE-1800 SCOTTISH ROOFS OTHER THAN THE REFERENCE BUILDINGS

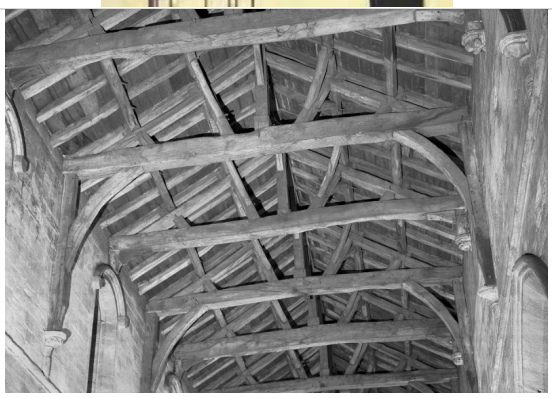
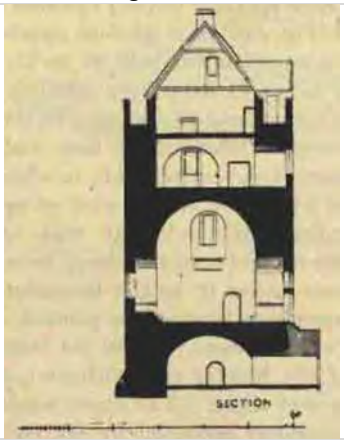
The roofs are in chronological order

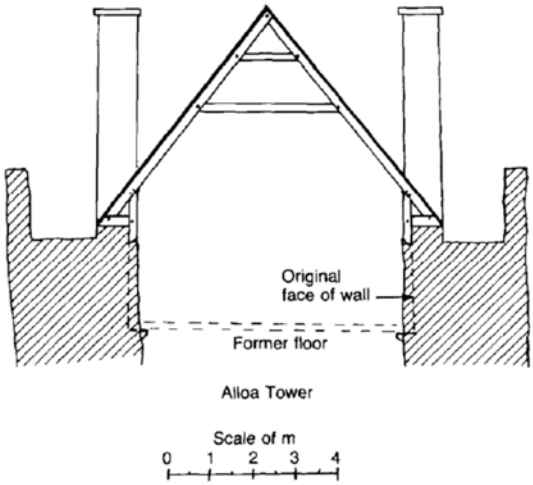
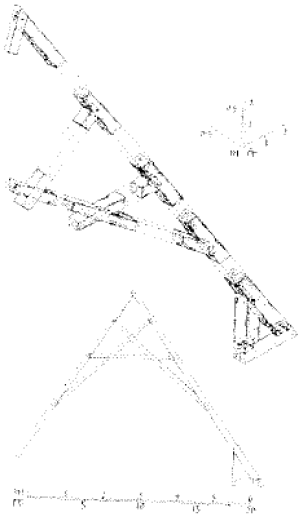
The first reference is the one referring to the drawing/picture

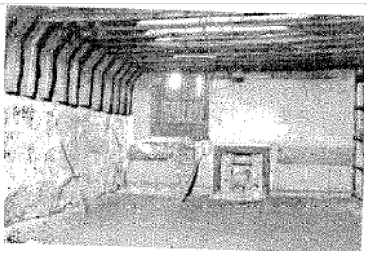
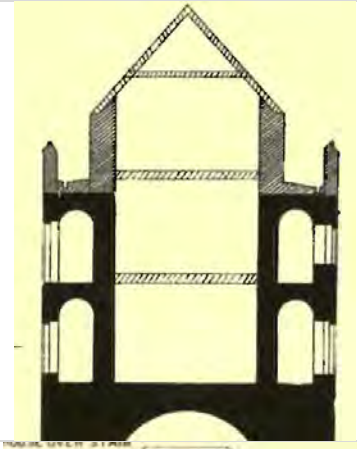
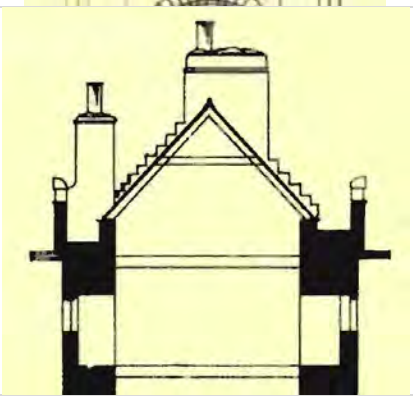
Building name	Roof construction date (estimated)	Retains pre-1800 roof?	Drawings/Pictures/Information	References
Temple Old Parish Church	12C	no		Hanke (2006)
Gullane St Andrew's Church	12C	no		Hanke (2006)
Holyrood Abbey	12C	no		Hanke (2006)
Cockpen Old Parish Church	13C	no		Hanke (2006)
Hailes Castle	13C	no		Hanke (2006)
Skipness Castle	13C			Macgibbon and Ross (1887-92)
Glasgow Cathedral	1256 choir roof, late 13C nave roof (1909 drawing)	yes	 Scottish oak (dendroanalysed), span 7.56m and 8.25m, common rafter roofs (choir and nave) with	RCHAMS DPM 1900/67/2 Oldriev (1916) Fawcett (2002) Hay (1976) Hanke (2006) Crone and Mills (2012)

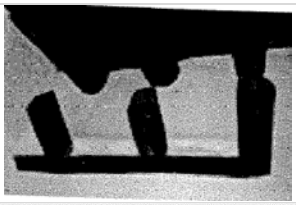
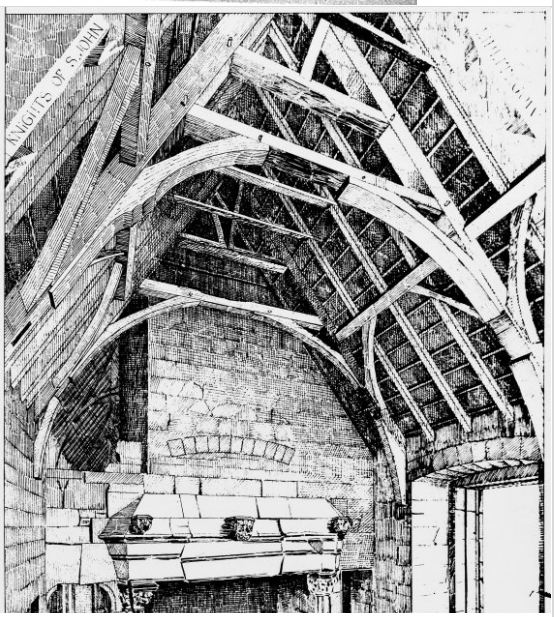
			one collar, scissor braces and rafter feet, mortice and tenon joints secured with wooden pegs	
Ormiston St Giles Church	13C	no		Hanke (2006)
St Andrew's Cathedral	1318	no		Hanke (2006)
Tantallon Castle (ruinous)	1360 (1923-30 picture)	no		RCAHMS SC 1201453
Darnaway Castle Hall	1387 but possibly dismantled and reassembled in 1802	yes	 Scottish oak (dendroanalysed), span 10.7m, 53° pitch, hammerbeam roof, roman numerals	RCAHMS SC 433080 Stell and Baillie (1993) Gomme (2002) Hanke (2006) Hay (1976) Crone and Mills (2012) Macgibbon and Ross (1887-92)
Dunfermline Palace	14/15C	no		Hanke (2006)

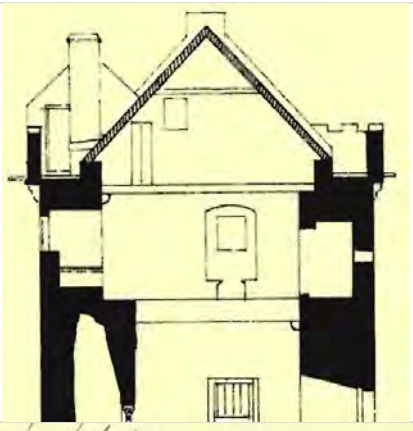
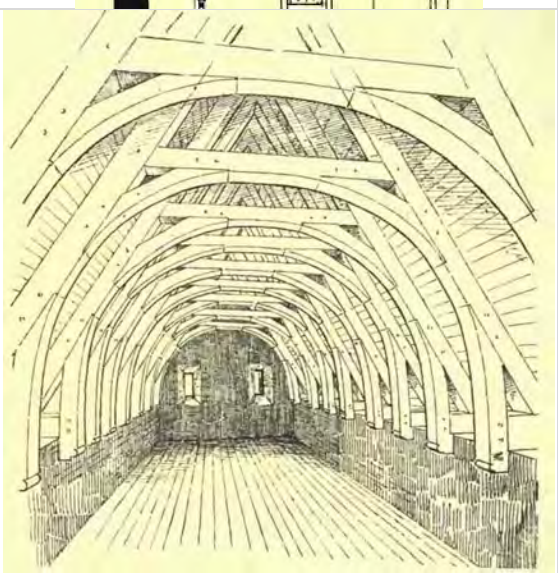
Craigneil Castle	14/15C			Macgibbon and Ross (1887-92)
Craigmillar Castle	14C to 17C	no		Hanke (2006)
St Andrew's Castle	1400	no		Hanke (2006)
Tullibardine Chapel	1446	yes	 oak, span 5.6m, common rafter roof with two collars and rafter feet, mortice and tenon joints secured by wooden pegs	picture by Author Hanke (2006) Fawcett (2002)
Perth St John Church	1448 (1927 drawing)	yes	 span 7.2m, open purlin roof with longitudinal bracing	RCAHMS SC 830680 Hanke (2006)
Threave Castle	mid 15C	yes	Scottish oak (dendroanalysed)	Crone and Mills (2012)

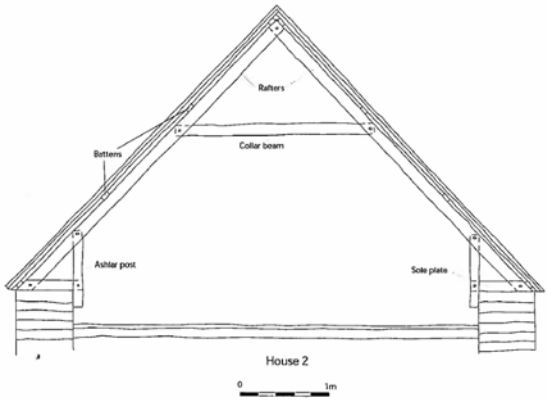
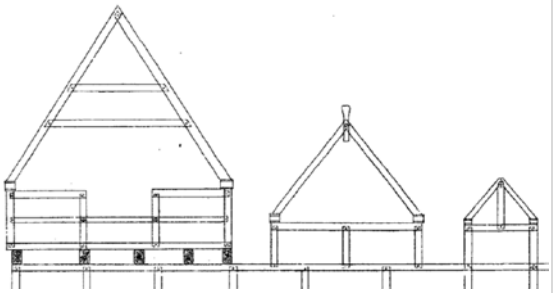
Cawdor Castle	1454			Macgibbon and Ross (1887-92)
Holy Rude Church Stirling	1455 (1959 picture)	yes	 span 6.3m, open purlin roof supported by principal frames with a central post and struts, posts and arched braces bringing load down on masonry wall, longitudinal bracing	RCAHMS SC 738897 Hanke (2006)
Guthrie Aisle	1464	yes	 Scandinavian oak (dendroanalysed), span 4.3m, common rafter roof with one collar and rafter feet, originally supporting vaulted painted timber ceiling underneath	picture by Author Hanke (2006) Crone and Mills (2012) Fawcett (2002)
The Dean Castle	1468-9			Macgibbon and Ross (1887-92)

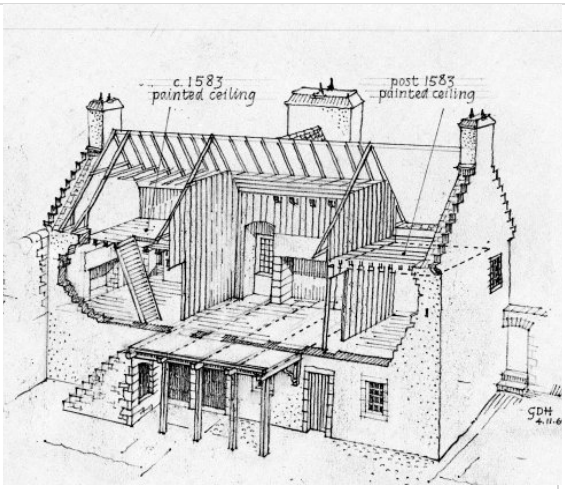
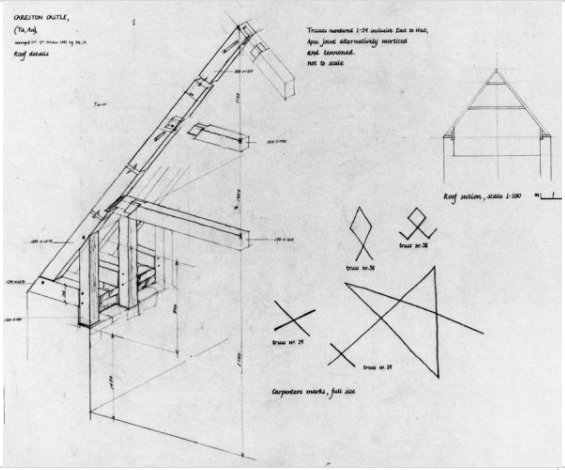
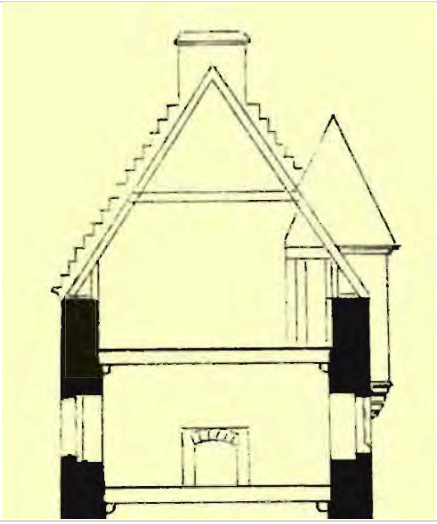
Provand Lordship Glasgow	1471	yes		picture by Scott Bain HES
Alloa Tower	1497, maybe earlier (1995 drawing)	yes	 oak, span 6.15m, 50/52° pitch, common rafter roof with two collars and rafter feet, mortice and tenon joints with timber pegs	Ruddock (1995) Hanke (2006)
Barns Tower	1498	no		Macgibbon and Ross (1887-92)
Ardchattan Priory	15C	yes	 common rafter roof with scissor braces	Hanke (2006) Fawcett (2002) Hay (1976)
Linlithgow Palace	15C	no		Hanke (2006)

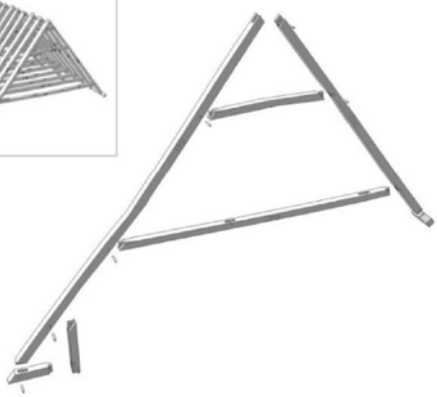
Merchiston Castle	15C	yes	 span 6.9m, common rafter roof with rafter feet	Hanke (2006)
Ackergill Tower	15C			Macgibbon and Ross (1887-92)
Inverquharity Castle	15C			Macgibbon and Ross (1887-92)
Cranshaws Castle	15C			Macgibbon and Ross (1887-92)
Innerwick Castle	15/16C	no		Hanke (2006)
Old townhouse in Dunbar	1509	yes	Norwegian oak (dendroanalysed)	Crone and Mills (2012)

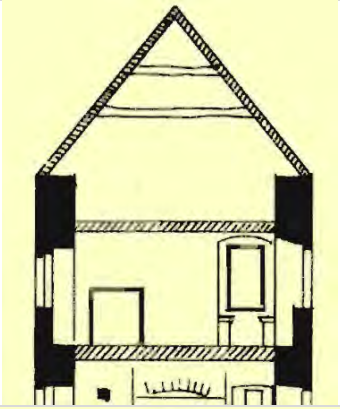
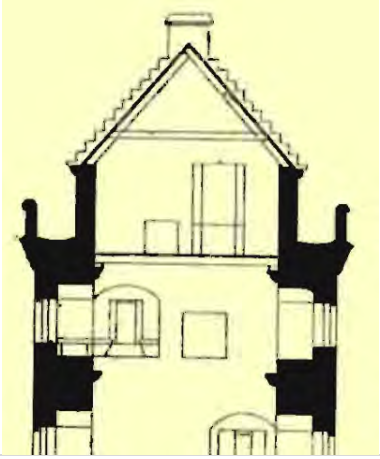
Edinburgh Castle Great Hall	1510 but heavily restored in 19C (1888 picture)	yes	 Scandinavia oak (dendroanalysed), span 10.1m, 45° pitch, false hammerbeam roof, roman numerals, maybe John Drummon wright	RCHAMS SC 1201162 Crone and Gallagher (2008) Hanke (2006) Hay (1976) Macgibbon and Ross (1887-92)
Dysart St Serf church	1511	yes	Scandinavian oak (dendroanalysed)	Anne Crone
Edinburgh 146 Canongate	early 16C	no (replaced in 20C)		Hanke (2006)
Linlithgow Town House of the Knights of St John (demolished)	early 16C (1886 drawing)	no	 span 5.7m, common rafter roof with primary and secondary frames and longitudinal bracing	RCAHMS SC 1047690 Macgibbon and Ross (1887-92) Hanke (2006) Hay (1976)
St Andrews St Leonard's Chapel	early 16C	no	reroofed in 1910	RCAHMS

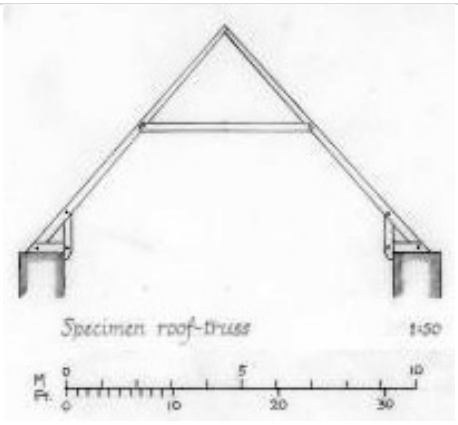
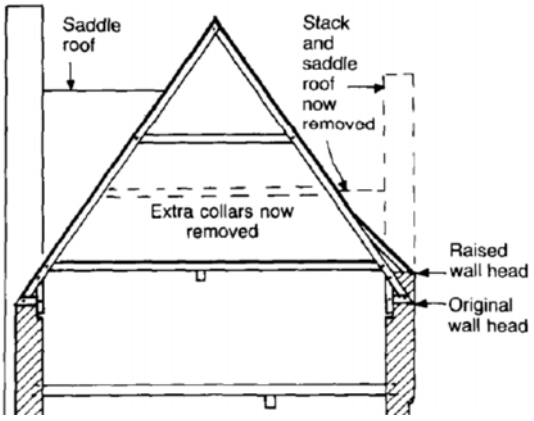
Castle Grant	1540	yes	 Scottish pine (dendroanalysed), common rafter roof with two collars and vertical struts between lower collars and rafters	pictures by John Addison engineer Crone and Mills (2011)
Oakwood Tower	1541	no		Macgibbon and Ross (1887-92)
Rusco Castle	1565			Macgibbon and Ross (1887-92)
Bardowie Castle	1566		 span 4.35m, common rafter roof with one collar and arch braces forming rafter feet	Macgibbon and Ross (1887-92) Hanke (2006) Hay (1976)

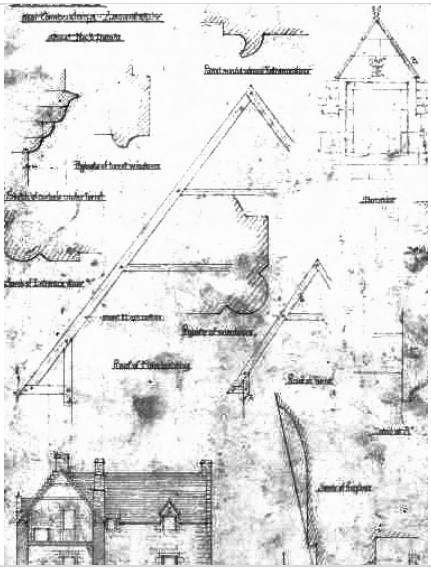
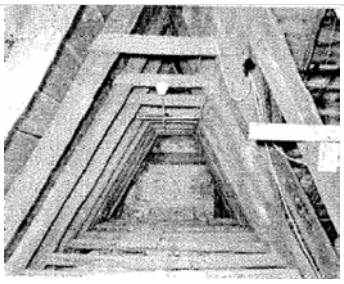
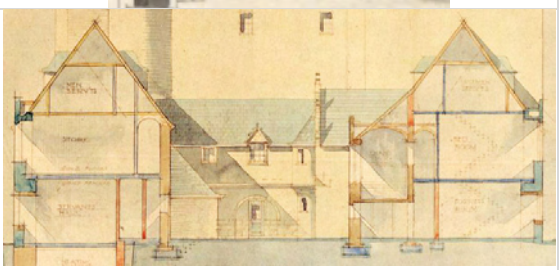
Claypotts Castle	1569-88	yes	 common rafter roof with a collar and rafter feet	RCAHMS AN 755 Hanke (2012)
Kinneil House (ruinous)	1570 (1929 picture)			RCAHMS SC 1214591
Brechin 68-74 High street	1575 with reused 1470 timbers	yes	 Scandinavian oak (dendroanalysed), common rafter roof with one collar and rafter feet, mortice and tenon joints secured by wooden pegs, big roughly sawn roman numerals	Crone et al. (2004)
Edinburgh Lawnmarket	1580	no (demolished before 1884)	 Oak, common rafter roofs on half timbered walls	Peddie (1883) Hanke (2006)

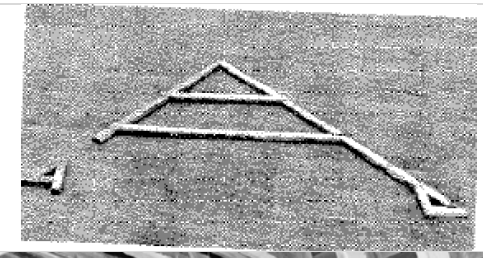
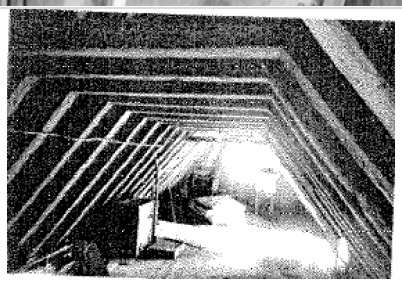
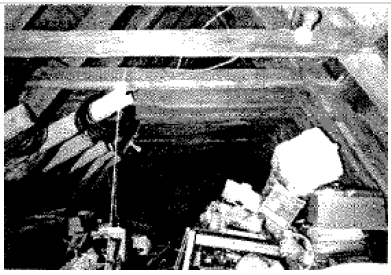
Dysart 1 pan ha	1583 (1969 drawing)	yes	 span 4.4m, common rafter roof with one collar and rafter feet	RCAHMS SC 989070 Hanke (2006)
Careston Castle	1586 (1992 drawing)			RCAHMS DC 290 22
Riddle's Court in Edinburgh	1587	yes	Norwegian oak (dendroanalysed)	Crone and Mills (2012)
Crathes Castle	1589-96	yes	Scottish oak (dendroanalysed), common rafter roofs with one collar, joints secured with wooden pegs, half baulks (timbers axed and then sawn in half)	Crone and Mills (2007)
Fourmerkland Tower	1590			Macgibbon and Ross (1887-92)

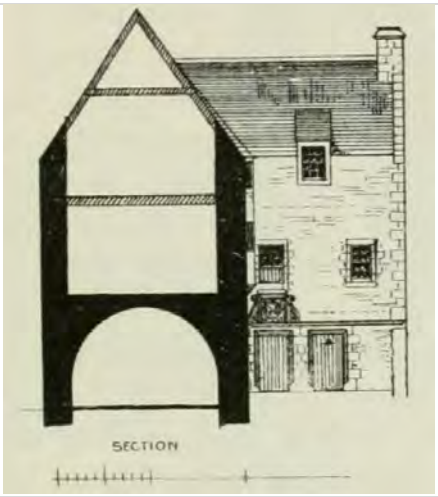
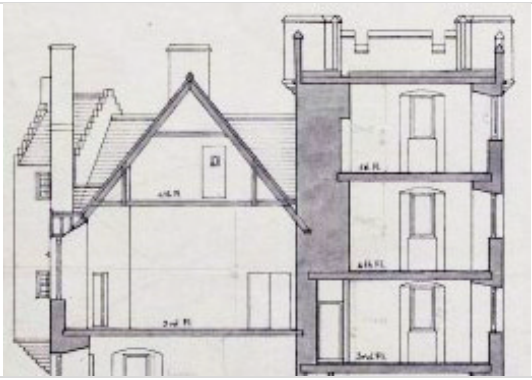
Newark Castle	1598	yes	  Scottish oak (dendroanalysed), common rafter roofs and a purlin roof, mortice and tenon joints secured by wooden pegs, square scantlings	Hanke (2012) Crone (2008)
Crichton Castle	16C	no		Hanke (2006)
Elcho Castle	16C	no	reroofed in 1830s	Graeme Bell HES
Grandtully Chapel	16C (1942 drawing)			RCAHMS SC 1451511

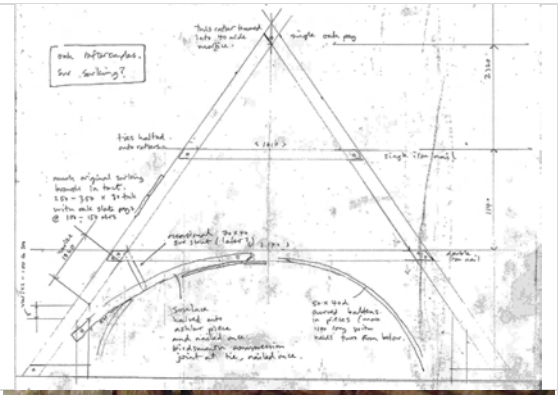
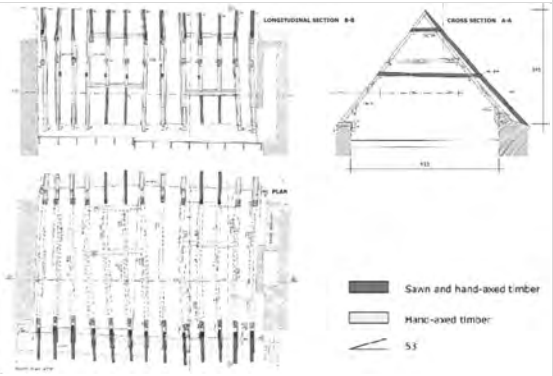
Stirling Castle Great Hall	16C but reconstructed in 20C	yes	 span 14.3m, hammerbeam roof, maybe John Drummon wright	Picture by Author Crone and Fawcett (1998) Gomme (2002) Hanke (2006)
Penkill Castle	16C			Macgibbon and Ross (1887-92)
Minto Tower or Fatlips Tower	16C			Macgibbon and Ross (1887-92)
Scotstarvit Tower	late 16C	no		Graeme Bell HES

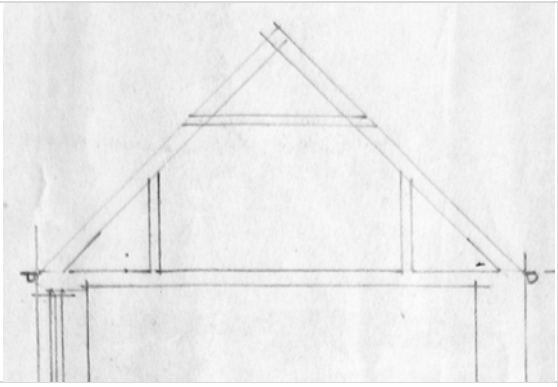
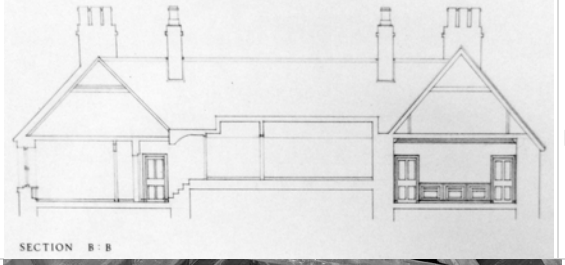
Tranent Tower	late 16C (1979 drawing)	yes	 span 9.3m, common rafter roof with one collar and rafter feet	RCAHMS DP 039231 Hanke (2006)
Drum Castle	1598-1621	yes	Scottish oak (dendroanalysed), common rafter roof with one collar	Shannon Fraser NTS Crone (2011)
Kirkcaldy 339-343 High Street	1600 (1995 drawing)	yes	 Baltic pine, span 7.3m, 53/55° pitch, common rafter roof with two collars and rafter feet, mortice and tenon joints with timber pegs	Ruddock (1995) Hanke (2006)
Moniack Castle	1600-10	no	reroofed in 1807-8	Gifford (1992)
Bruntisfield House	1605	no	unroofed	Steven Robb HES
Lamb's House in Leith	1608	yes	Scandinavian pine and Norwegian oak (dendroanalysed)	Anne Crone

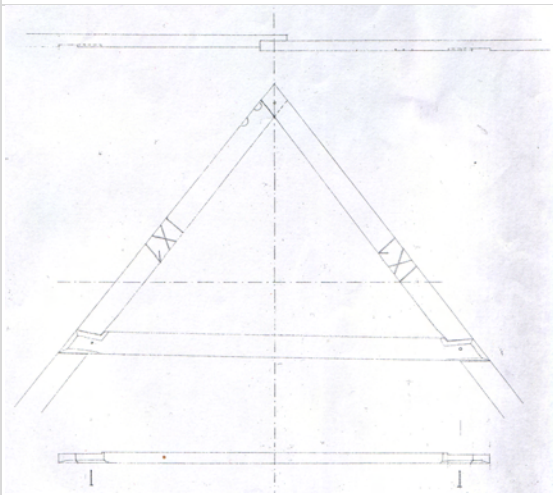
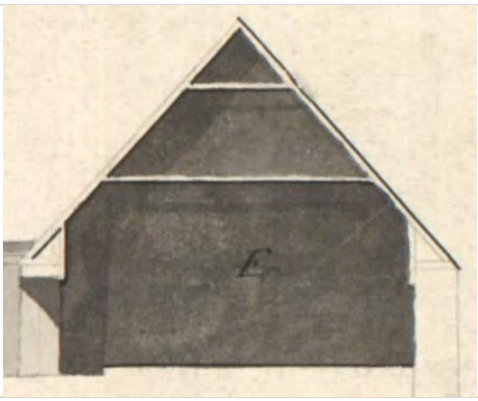
Gilbertfield Castle	1607 (1900 drawing)	no (ruinous)		RCAHMS DP 225199
Craigievar Castle	1610-26	no	reroofed in 1826	Crone and Mills (2011)
Northfield House	1611	yes	 common rafter roof	Hanke (2006)
Dirleton Church	1612	yes		HES
Edinburgh Castle Chapel	1615 (1719 drawing)	no		NLS Military Maps MS.1645 Z.02/01e Macgibbon and Ross (1887-92)
Fraser Castle	1615-30, stables late 18C (1980 drawing)	yes	 pine, common rafter roofs with two collars and attic rooms in between, collars are half baulks (timbers axed and sawn in two), rafters are full	RCAHMS ABD/18/14 Shannon Fraser NTS Crone and Mills (2011)

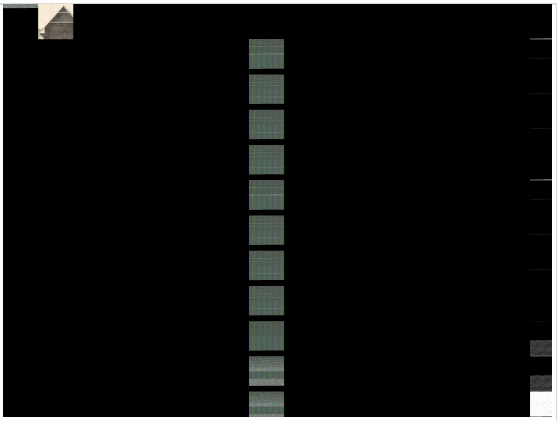
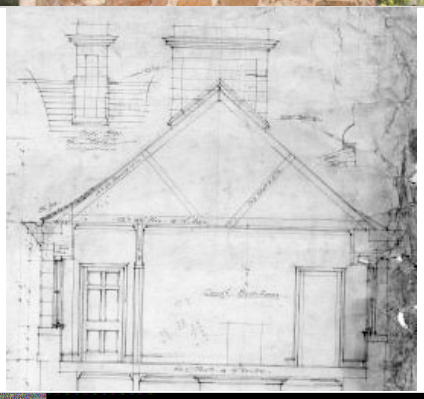
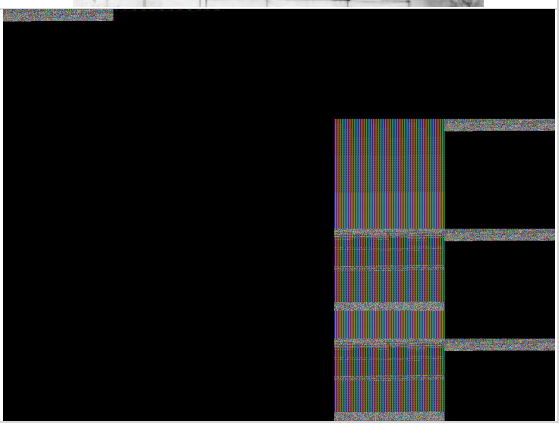
			baulks	
Binns House	1621-30	no (replaced in 1990s)		Owner Hanke (2006)
Provost Skene's House	1622 (1952 picture)			RCAHMS SC 1327351
Baberton House	1622-23	yes	 common rafter roof	Hanke (2006)
Black Castle South Queensferry	1623	yes	 common rafter roof	Hanke (2006)
Cupar Preston Lodge	1623	no	roof raised and replaced	RCAHMS
Pilrig House	1623	no	roofless in 1975	RCAHMS

Saughton Mills	1623			Macgibbon and Ross (1887-92)
Stewart Castle	1625 (1948 drawing)			RCAHMS DP 171707
Neidpath Castle	1625-50	probably not	roofless in 19C drawing	RCHAMS
Culross Tolbooth	1626	yes	span 7.3m, common rafter roof	Hanke (2006)
Hamilton House	1628	yes	common rafter roof	Hanke (2006)
Edinburgh Parliament Hall	1631-40	yes	 oak, span 13m, 15° pitch, open purlin roof supported by arch system, John Scott wright	picture by Author Gomme (2002) Hanke (2006) Hay (1976) Hannay and Watson (1924)
Acheson House	1633	no	reroofed in 1930s	Ben Tindall architect
Invermay Old House	1633	no		Owner

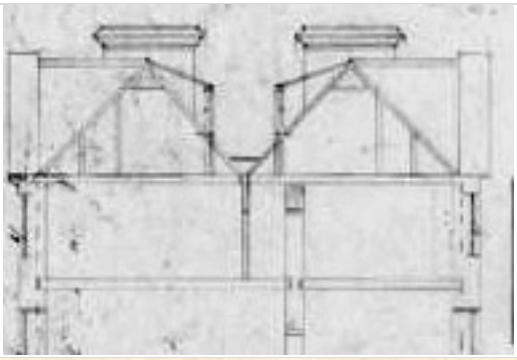
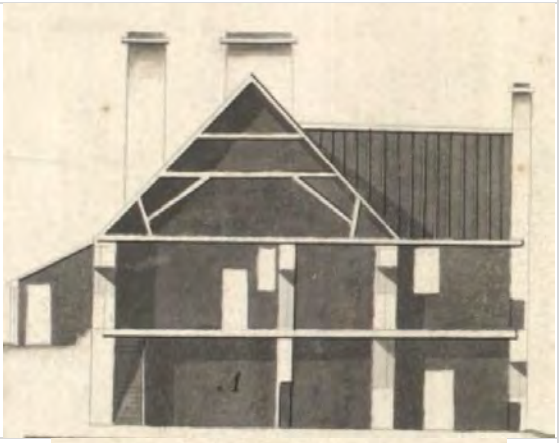
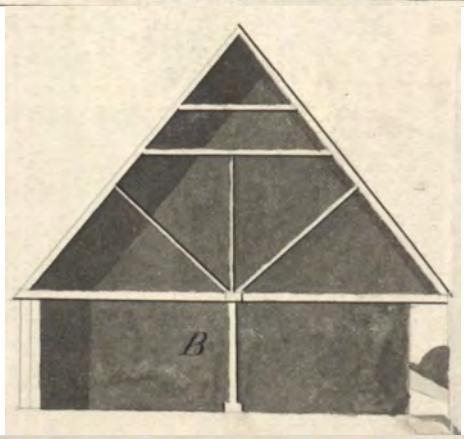
Skelmorlie Aisle	1636	yes		Ian Lambie HES
Edinburgh Tron church	1636-47	yes	 open purlin roof supported by arch system, John Scott wright	picture by Author Gomme (2002) Hanke (2006) Hay (1976)
Halkerston Lodge	1638-42	yes	 conifer, span 4.15 m, pitch 53°, common rafter roof with rafter feet and pyramidal roof, big roughly sawn roman numerals	Hanke (2004)
Moray House	1640	yes	 spans 5.8m and 7.2m, common rafter roofs with one collar and rafter feet, one has scissor braces	Hanke (2004)
Lyne Church	1640-5	yes		Ian Lambie HES

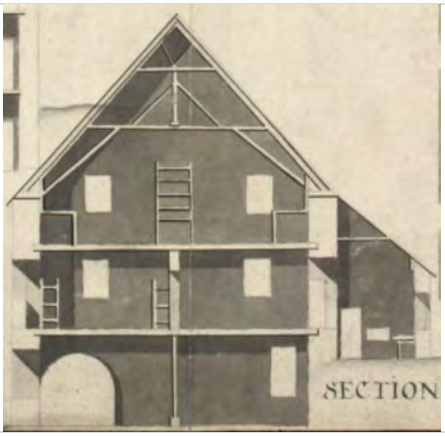
Auchterhouse	mid 17C (1923 drawing)			RCAHMS AND/8/8
Leith Hall	mid 17C	yes	pine	Shannon Fraser NTS
Provan Hall Glasgow	mid 17C	yes	 56° pitch, big roughly sawn roman numerals	Hanke (2009)
Arbuthnott House	1660 (1972 drawing)			RCAHMS KCD/72/6.P
Rowallan Castle	1661 (1993 picture)			RCAHMS SC 1133552
Dirleton Castle	1660s	no		Hanke (2006)
Craignethan Castle	1665	yes		Ian Lambie HES
Queensberry House	1667-70	no	reroofed in 21C	Cristina Gonzalez Longo

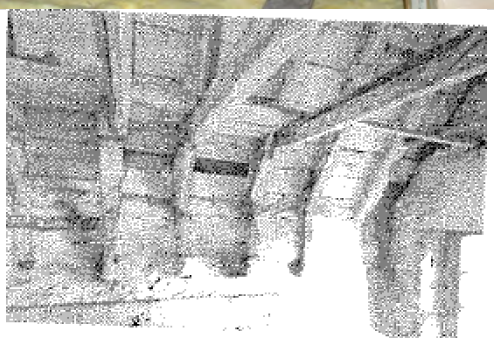
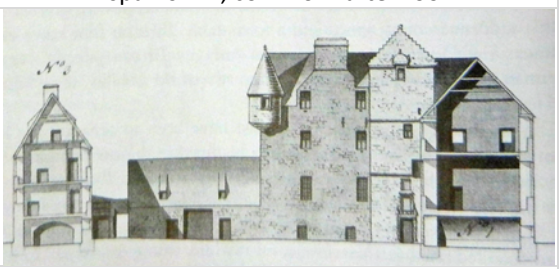
				architect
Lauder Parish Church	1673-4	yes	 common rafter roof with dovetail joints	Hanke (2008)
South Leith Parish Church	1674	no	entirely renovated in 1848	RCAHMS
Edinburgh Castle Powder Magazine (demolished)	1677-80 (1719 drawing)	no		NLS Military Maps MS.1645 Z.02/01c
Ferniehurst Castle Chapel	1680	no	picture without roof	RCAHMS
Ford House	1680	yes		Ben Tindall architect
Craigiehall House	1695-9	no	reroofed in 1951	RCAHMS
Edinburgh Old Surgeon's Hall	1697	no	extra floor added in 19C	HES
Newbattle Sun Inn	1697	no		Owner
Drummuir Mains	17C	no		Crone and Mills (2012)
Edinburgh Greyfriars Church	17C	no	reroofed in 1845	HES
Haddington House	17C		span 5.5m, common rafter roof	Hanke (2006)

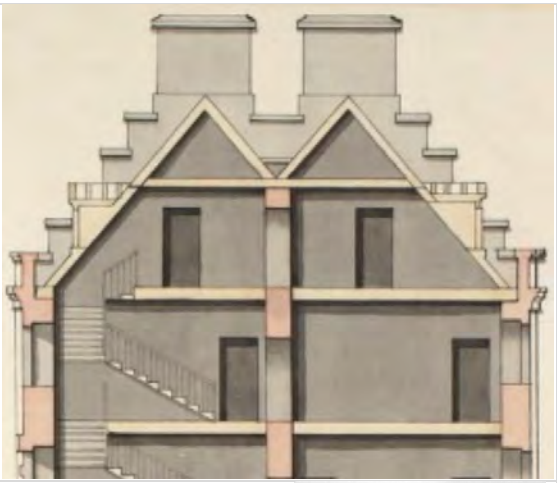
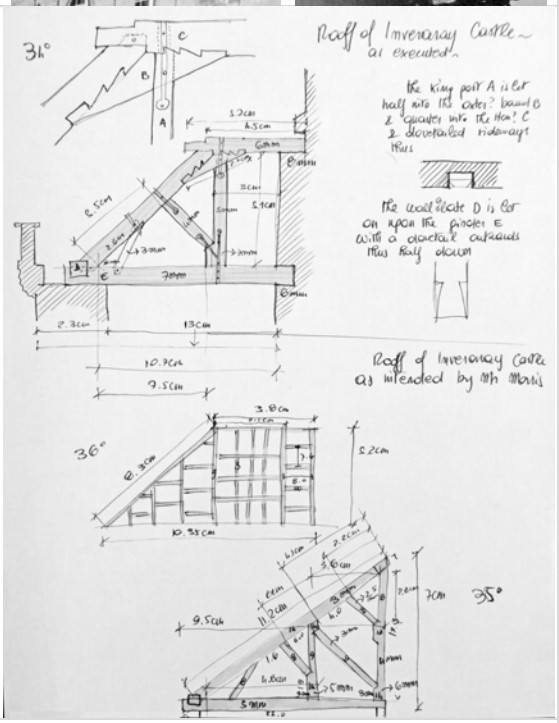
Hunting Tower Castle	17C	yes	 purlin roof with common rafters and sarking supported by frames composed of rafter couples, a tie-beam, a collar and two vertical struts between tie-beam and collars	picture by Author
Sornhill Farm	17C (2006 picture)			RCAHMS DP 010524
Lennoxlove House	17C or early 19C			RCAHMS DP 002754
Bannockburn House	end 17C	yes		picture by David Mitchell HES

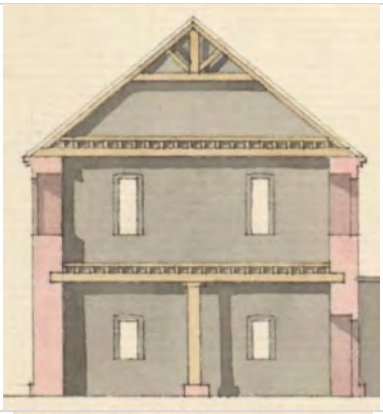
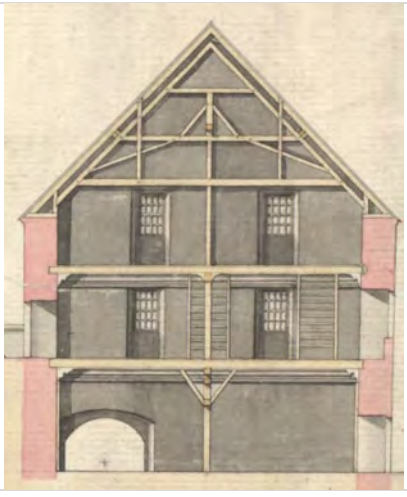
Moy Hall (demolished)	1700 (1872 drawing)	no		RCAHMS DP 006446
Dalkeith Palace	1702-11	yes	  platform roof with common rafters	pictures by Author
Polwarth Church	1703			RCAHMS
Mertoun House	1703-7	no	reroofed in 1915	Owner
Bowhill House	1708	probably not	raised one storey in 1831-33	Cruft (2005)
Edinburgh Castle Old Barracks	1708 (1754 drawing)			NLS Military Maps MS.1645 Z.02/14a
Gifford Parish church	1710	yes	common rafter roof	Hanke (2004)
Lethen House Granary	early 18C	no		Crone and Mills (2011)
Skellater House	early 18C	yes	common rafter roof with dovetail lapped collars secured by nails	Hay (1976)

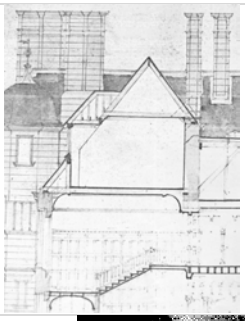
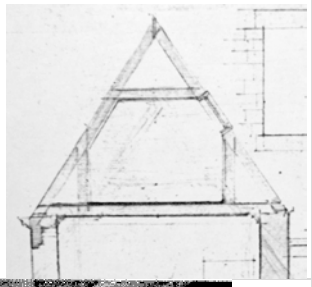
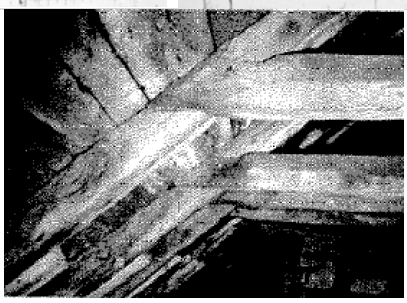
Bute Mount Stuart	1718	probably not (rebuilt 19C)		RCAHMS BMS/7/4
Edinburgh Castle Late Major Apartments (not sure which building it refers to)	1719 drawing			NLS Military Maps MS.1645 Z.02/01c
Edinburgh Castle Carriage Sheds (not sure which building it refers to)	1719 drawing			NLS Military Maps MS.1645 Z.02/01c
Edinburgh Castle Grand Storehouse (not sure which building it refers to)	1719 drawing			NLS Military Maps MS.1645 Z.02/10

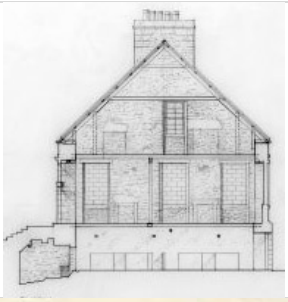
Edinburgh Castle Storehouse (not sure which building it refers to)	1719 drawing			NLS Military Maps MS.1645 Z.02/01b
Durisdeer Parish Church	1716-29	no	reroofed in 1957	HES
Hopetoun House South Pavilion	1721-48	yes		pictures by Author
Hopetoun House North Pavilion (Stables)	1721-48			(RCAHMS SC 767049, 1995)
Drum House	1723	yes		Owner
Harehope House	1723	no	raised one storey in early 19C	HES
Newbattle Parish church	1725	yes	common rafter roof, 9.16m span, struts linking rafters and collars	Hanke (2006)

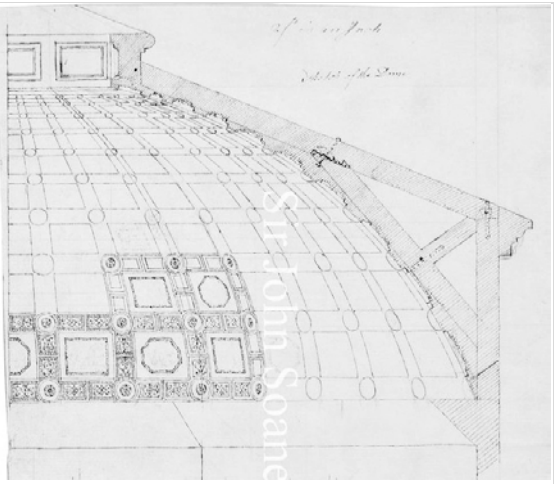
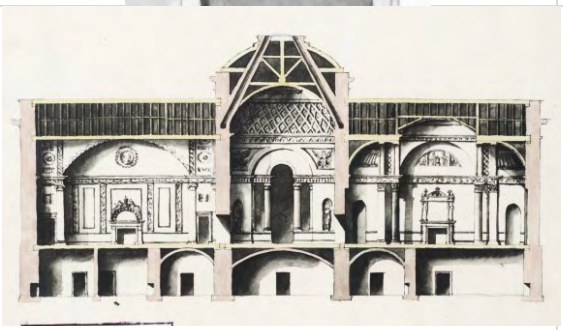
Chatelherault Hunting Lodge	1731-43	no	roofs fallen before restoration in 1978-87	Building manager
Hermits and Termites	1734	yes		Ben Tindall architect
Dumbarton Castle Governor's House	1735	yes		picture by Ian Lambie HES
Edinburgh St Ninian's Manse	1735	yes	 span 6.4m, common rafter roof	Hanke (2006)
Gowrie Lodging	1740 drawing			NLS in McKean (2001)
Skye Lyndale House	1740	no	reroofed in 1900	RCAHMS
Gartmore House	1740-5	no	mansard roof added in 1901/2	Adam (1812)
Glenkindie House	1741	no		Crone and Mills (2011)

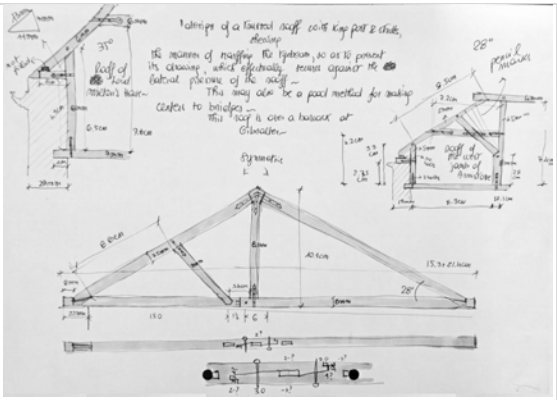
Edinburgh Castle Governor's House	1742 (1742 drawing)			NLS Military Maps MS.1645 Z.02/05c
Inveraray Castle	1744-61	no (reroofed after fire in 1975)	  	Pictures from building manager Author copy of a drawing in John Adam's diary held at Blair Adam
Edinburgh Castle Mills Mount Shed	1746 (1746 drawing)	yes		NLS Military Maps MS.1645 Z.02/06a

Edinburgh Castle Storehouse	1748-54 (1753-4 drawing)			NLS Military Maps MS.1645 Z.02/13b
Edinburgh Castle Powder Magazine (demolished)	1748-54 (1747 drawing)	no		NLS Military Maps MS.1645 Z.02/07b
Burntisland Parish Church	1748-1822	yes	dovetail joints	Hanke (2008)
Bellabeg Mill	mid 18C	no		Crone and Mills (2011)
Dumfries House	1754-9	no	concrete attic built in 1923	Charlotte Rostek NTS
Edinburgh Castle Barracks (demolished)	1755 (1754 drawing)	no		NLS Military Maps MS.1645 Z.02/14a

Ballochmyle House	1760		 	RCAHMS DC2067
Musselburgh Tolbooth	1762	yes	 span 5.6m, common rafter roof, dovetail lapped collars	Hanke (2006)
Applegarth Parish Church	1762-3	no	reroofed in 1884	Gifford (1996)
Edinburgh St Cecilia's Hall	1763	no	reroofed in 20C	RCAHMS
Gayfield House	1763-5	yes	 platform roof with common rafters	picture by Author
Edinburgh Royal Botanic Gardens Cottage	1764-5	yes but dismantl ede and reassem bled	 common rafter roof with one collar, joints between rafters and collars are dovetail lapped	Picture by Author
Ardgour	1765	probabl	roof remodeled in 1826-30 after a fire	Gifford

House		y not		(1992)
Clestrain Hall	1769 (1998 drawing)			RCAHMS DP 112429
Edinburgh New Barracks	1769-99 (1755 drawing)			NLS Military Maps MS.1646 Z.02/15
Penicuick Parish church	1771		common rafter roof	Hanke (2006)
Kinglassie Parish Church	1773-4	no	reroofed in 1887-88	HES
Pitlour House	1774	yes		HES, RCAHMS and John Addison engineer
Alness Old Parish Church	1775	no	unroofed in 1970	Gifford (1992)
Baillie Craig's House	1775	no	reroofed in 1890	McKean et al. (1989)
Abernethy Old Parish Church	1775-9	no		Crone and Mills (2011)
Canna the Bothy	1781-7	probably not	reduced to single storey in 19C	RCAHMS
Dalquharran Castle	1782-90	no		HES and RCAHMS

Edinburgh Assembly Rooms	1784-7		 drawing by James Adam	Adam (1755)
New Tarbat House	1787	no	roofless after fire in 1988	BARR
Dumbarton Castle Barracks (not built)	1788 drawing	no		NLS Military Maps MS.1649 Z.03/49
Gosford House	1790-1800		 Robert Adam	Adam (1812)
Glenbuchat Old Parish Church	1792	no		Crone and Mills (2011)
Inverness Greyfriars Free Church	1792-4	probably not	heighteneed in 1822	Gifford (1992)
Applecross Old Manse	1796	probably not	top floor heightened in 19C	Gifford (1992)

Edinburgh Lord Milton's House	18C		 drawing of roof of Lord Milton's House (possibly the one in Edinburgh), of Arniston House's roof and a roof in Gibraltar	Author copy of drawing in John Adam's diary held at Blair Adam
Bush House Adam Office Wing	18C	no	reroofed in 19C	HES
Newe Mill	18C	no		Crone and Mills (2011)
Strathleven House	18C	no	roof burnt	Cristina Gonzalez Longo architect

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APPENDIX B

ONLINE QUESTIONNAIRES TO BUILDING OWNERS, USERS, MANAGERS, PROFESSIONALS IN CHARGE OF THE BUILDING MAINTENANCE

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Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Arniston House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

1970

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  May Dundas Arniston Trustees
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  Please see our online list at Register House for older documents. We are in the process of listing more recent documents such as plans etc for our archive room.
- ( ) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- (•) Yes
- ( ) Partly (please specify what is missing)
- ( ) No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [x] Roof covering (slates, lead, etc)
  Chimneys require repair.
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Inspection of roof structure (timbers and sarking)	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑

***Q13.* Please specify what the programmed works involve:**

Structural report followed by prioritised works where resources allow

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- (•) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)	1980	Roof material not fit for purpose	Roofing specialist	Complete relead of main roof
Repairs to flashings				
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Location Data

Location: (51.496398925781, -0.12240600585938)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Balcaskie, Fife

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Owned since around 1680. In charge of it since 2000. Lived in since 2008

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  yes. Owner: William Bruce (architect) Occupant: Sir Ralph Anstruther (d. 2000) Manager: various
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  Yes - archive at Nat Archives of Scotland and St Andrews University. Various theses written previously (all on public record)
- ( ) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ( ) Yes
- (•) Partly (please specify what is missing)
  Partly. Some restricted access. Some care needed in many attic/roof spaces
- ( ) No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  Mainly.
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☐ Structure (timbers and sarking)
- ☑ Roof covering (slates, lead, etc)
  Odd slates missing (due to be repaired) but only as usual
- ☐ Flashings
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☑	☐

***Q13.* Please specify what the programmed works involve:**

Regular inspection. Repair as needed. Regular programmed repainting of exposed metal (rones and skylights) and wood (windows).

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	None needed			
Repairs to roof covering (slates, lead, etc)	Annually	Missing slates	Roofer	Replaced slates
Repairs to flashings	As req'd			

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Sorry for the delay in completing this survey! Kind regards, Toby

Location Data

Location: (43.774200439453, 7.4990997314453)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Blair Adam House.

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Stephen Newsom, info@stephennewsom.co.uk

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Since inheriting in 1988.

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  Father. Deceased.
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  Many.
- ( ) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ( ) Yes
- (•) Partly (please specify what is missing)
  Some parts are less easy than other parts. i.e. one may need to squeeze tthrough some narrow spaces. Some parts not accessible to move across as too fragile.
- ( ) No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  Mostly. The library roof is not visible owing to the curving barrel shaped ceiling being close to the roof timbers.
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  Yes. North side of the South Section has some poor sarking/timbers.
- ☑ Roof covering (slates, lead, etc)
  Which will be repaired before complete reslating work.
- ☑ Flashings
  A lead valley on the Central Section will need remedial work, probably complete renewal, although this had previously been done aprox 1960.
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☑	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

A very gradual programme of phased renovation works as funds allow. After a long period of minor repairs we are now embarking on a further stage of work. This will be Phase 4, with the formal first phase beginning about 1970 although other repair works had been done prior to then.

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ○ Yes
- ○ No
- ◉ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	From 1970	Deterioration	Tradesmen	
Repairs to roof covering (slates, lead, etc)	From 1970	Deterioration	tradesmen	

Repairs to flashings	From 1970	Deterioration	tradesmen	
Repairs to attic ceiling	From 1970	Deterioration	tradesmen	

***Q17.* Please give any further comments:**

Most receipts for the three previous phases have been retained.

Location Data

Location: (51.573394775391, -0.42340087890625)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Blair Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☑ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: User , building manager

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Estate Property manager

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Involved in maintenance since 2012

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Yes
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Yes
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  Yes
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  Sarking - damp being replaced
- ☑ Roof covering (slates, lead, etc)
  Yes - slates old being replaced
- ☑ Flashings
  Damaged, being replaced
- ☑ Attic ceiling
  Damp -work above should solve

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Inspection of roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

Replacement of slates, use of membrane, replacement of sarking and timbers if required. Two sections of roof complete, 1 underway this year 1 part to monitor

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	Previously present programme since 2012	Damp and woodworm	Various. Bruar Construction	New sarking
Repairs to roof covering (slates, lead, etc)	Previously and present programme since 2012	Leaks	Bruar Construction	new slates

Repairs to flashings	Over many years	Leaks	Various trademen	lead work
Repairs to attic ceiling	None	None	none	none

***Q17.* Please give any further comments:**

Location Data

Location: (55.952102661133, -3.1965026855469)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Brodie Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☑ Building manager
- ☐ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

1997

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Yes, John Dymock NTS Surveyor (deceased)
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Some considerable archive files
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  In places there are safe walk boards. Some hatches are constrictive. Some roof spaces have known bat roosts. Our team have survey equipment to allow access and operate a risk assessment and method statement for surveying roof spaces.
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  Due to coombed ceiling there are areas that are no on show. Also insulation obscures timbers in limited places
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  One live issue with a sunk valley rafter picked up in recnet quinquennial survey.
- ☐ Roof covering (slates, lead, etc)
- ☐ Flashings
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☑	☑	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

We have a measured term contract for roof maintenance and repair that is undertaken in May and November of each year. This examines all lead, slate, cast iron and drainage, or any other potential fabric deficiencies that could lead to water ingress. There is a defined performance specification for the works

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (56.117401123047, -3.5345001220703)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Cowane's Hospital

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Charity Administrator

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

The Cowane's Hospital Maintenance Trust, Registered Scottish Charity SCO42873, 49 St John Street, Stirling, FK8 1ED 01786 472247

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2011

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Patrons of Cowane's Hospital Trust Registered Scottish Charity SCO19364 49 St John Street Stirling FK8 1ED 01786 472247
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes Plans Drawings Optional Appraisals
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  No access
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  Other parts of the building not accessible
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☐ Structure (timbers and sarking)
- ☑ Roof covering (slates, lead, etc)
  Need replaced in parts
- ☑ Flashings
  loose
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

Ad hoc until the proposed restoration programme in 2017

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)	2015	loose slates	roofer	replace slates
Repairs to flashings				

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

The Charity has been successful in securing funding from the Heritage Lottery Fund stage 1, stage 2 application is due in 2017 and if successful will undergo restoration

Location Data

Location: (53.479202270508, -2.2859039306641)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

culross palace

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☑ Architect in charge
- ☑ Other: Building Surveyor

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Surveyors - East area of NTS

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

1996

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  HES
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  yes - many
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  risk assessment required before entry
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [x] Roof covering (slates, lead, etc)
  limited life and appropriate replacement material to be decided
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☐	☑	☐	☑	☐	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

general roof maintenance

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- (•) Yes
- ( ) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

records would need to be checked for details to support previous question - many works are undertaken to the Palace

Location Data

Location: (55.932601928711, -3.2530975341797)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Culzean Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Building Surveyor in charge of maintenance

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

N/A

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

The organization (NTS) has owned the building since 1945. I have been in charge of its maintenance since 2000

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Yes. Kennedy family (pre-1945)
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes. some original drawings exist. We have maintenance records from the period 1945-1980 and detailed records of work done between 1980 to date.
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Some parts of the roof are flat lead covered decks with no accessible void below
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○

○ No (please specify why)

***Q12.* Are the roof timbers visible?**

◉ Yes

○ Partly (please specify where they are not visible and why)

○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

☑ Structure (timbers and sarking)
Structure appears to be in satisfactory condition

☑ Roof covering (slates, lead, etc)
Coverings are in fair condition. Frequent maintenance is undertaken along with a programme of ongoing repairs

☑ Flashings
There are a large number of cover flashings throughout the roof. Due to ongoing stone decay, many of the cover flashings have been renewed when raggles recut/ reformed.

☑ Attic ceiling
appears satisfactory

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☑	☐	☐	☐	☑	☑	☐	☑
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☑
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐	☑
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☑

***Q13.* Please specify what the programmed works involve:**

1. Cleaning gutters, valleys, roof penetrations/ rooflights etc. Sweeping down pitches, replacing slipped slates. inspecting leadwork & general features and undertaking small repairs as necessary. 2. Planned repairs including flashing replacement, re-slating sections, masonry repair & repointing

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

◉ Yes

○ No

○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	2012	Decay discovered	Roofing contractor	Replacing decayed sarking

Repairs to roof covering (slates, lead, etc)	2015	Replacing slipped slates	Roofing contractor	renewing slipped slates
Repairs to flashings	2015	Flashing found to be damaged	Roofing contractor	Removing rooflight. Replacing flashings & refitting rooflight
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

The roof is large and complex. The key to maintaining the roof in satisfactory condition is to carry out regular inspections during regular cleaning/ maintenance regimes and follow up any necessary work required by undertaking the necessary repairs. If regular cleaning/ inspection work was to stop, the roof condition would deteriorate rapidly.

Location Data

Location: (56.460998535156, -2.9765930175781)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Duff House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☑ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

HS/HES Duff House 1992

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Yes various
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes building files
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Parts -
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Areas between double piles and areas without access hatches
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [ ] Roof covering (slates, lead, etc)
- [x] Flashings
  Some failure
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☑	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☑	☐	☑	☐	☑	☐	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

Depends what is identified during inspection

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- (•) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	1993	Dry rot and general needs	HS/contractor	repairs and replacement
Repairs to roof covering (slates, lead, etc)	as above	as above	as above	as above
Repairs to flashings	as above	as above	as above	as above
Repairs to attic ceiling	as above	as above	as above	as above

Q17. **Please give any further comments:**

Location Data

Location: (41.11149597168, 16.855392456055)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Fountainhall

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Na

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2014

Q8. **Do you know who the previous owners, tenants or managers were?**

- ○ Yes (please specify name and contact details if known)
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ○ Yes (please specify what documents you have)
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

Q12. **Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q13. **Please specify what the programmed works involve:**

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- ( ) Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Location Data

Location: (53.533294677734, -1.1499938964844)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Gardyne's land

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☑ Building manager
- ☐ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Dundee City Council

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

I've been living in the building since September 2013

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Building was unoccupied until renovation in 2008.
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes, hostel has all the renovation plans and photos of the building's condition before.
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- (•) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Location Data

Location: (56.460998535156, -2.9765930175781)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Gayfield House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Owned since 2012, resident since early 2013

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  Yes. Previous owner is Trevor Harding, a former roofer. I can pass a message to him if required.
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  We have copies of some 19th century drawings that are in public collection and second hand published and private accounts of construction.
- ( ) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ( ) Yes
- (•) Partly (please specify what is missing)
  Access is through a small hatch and space is very limited. I can get in but not very easily and moving around inside is quite tricky.
- ( ) No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  I am not aware of any major problems with the roof, but there are associated issues with cracking urn finials, a leaking rooflight and gutters
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

No programmed works underway but we will need to address urn finial cracking

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- (•) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

I don't have detailed records of past roof work but I believe substantial repair was carried out by the previous owner

Location Data

Location: (55.952102661133, -3.1965026855469)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Geilston House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Building Surveyor

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2001

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  John Young NTS Building Surveyor
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Archaeological Reports and Surveys
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Access not available in all areas. No ladders, etc provided other than those on site.
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  Minor areas of decay and deflection
- [x] Roof covering (slates, lead, etc)
  Slates/Tiles
- [x] Flashings
  Lead/Mortar
- [x] Attic ceiling
  Plaster/Timber

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

maintenance, repairs and Inspection

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- (•) Yes
- ( ) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	c2005	Decay	NTS	Local repairs
Repairs to roof covering (slates, lead, etc)	Annual	Maintenance	NTS	Local repairs
Repairs to flashings	Annual	Maintenance	NTS	Local repairs

Repairs to attic ceiling	na	na	na	na

***Q17.* Please give any further comments:**

Location Data

Location: (55.63330078125, -3.1833038330078)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Fort George

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☑ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Fort george HES/HS 1962

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Yes various
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes building files and original work book and board of ordnance drwgs for Fort George
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Parts -
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Areas between double piles and areas without access hatches
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  Mostly OK but local water ingress.
- [x] Roof covering (slates, lead, etc)
  slates are maintained regulalry but there is oftern storm damage etc. Modern roof coverings have failed.
- [x] Flashings
  Some failure
- [x] Attic ceiling
  Some water ingress

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☑	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☑	☐	☑	☐	☑	☐	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

Depends what is identified during inspection

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- (•) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Bit difficult to answer as FG is a large site.

Location Data

Location: (41.11149597168, 16.855392456055)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Glamis Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Archivist

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Mark Wedderburn, Glamis Castle

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

N/A

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  The Castle has been owned by the Strathmore family since the 15th century
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes. See National Register of Archives Scotland -NRA(S) Survey list 885.
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Yes
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Yes
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ○ Partly (please specify where they are not visible and why)
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  General Roof repairs were recetly carried out at the end of February/beginning of March 2016
- ☐ Roof covering (slates, lead, etc)
- ☐ Flashings
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ○ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Roof repairs were carried out at the end of February/beginning of March 2016. The roof is checked every year and there is a 4 year rotation maintenance schedule.

Location Data

Location: (56.649993896484, -2.88330078125)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Haddo House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Building owned by National Trust for Scotland

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Surveying team NE

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

National Trust for Scotland took ownership in 1979

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  The Gordon Family of Aberdeenshire
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  There is an archive which includes original architects drawings, some are on display at Haddo, others are held by Haddo Estate (the Gordon family)
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Some areas of flat roof
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  In some areas only

○ No (please specify why)

***Q12.* Are the roof timbers visible?**

○ Yes

◉ Partly (please specify where they are not visible and why)
In accessible areas only

○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

☑ Structure (timbers and sarking)
No current issues - historic insect attack in some areas

☑ Roof covering (slates, lead, etc)
On-going maintenance requirements due to age of roof for slipped slates etc.. extensive leadwork done in 2015

☑ Flashings
Extensive leadwork done in 2015 to parapet walls

☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

Routine clearance of rainwater goods, high level inspections and minor repairs

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

◉ Yes

○ No

○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	2014	Water ingress	Roofing contractor	Repalcement sarking in areas and lintols to window below at Chapel cupola

Repairs to roof covering (slates, lead, etc)	every year	good maintenance practice	roofing contractor	slipped slates, gutter clearance etc..
Repairs to flashings	2014-15	Defective detailing at raggle	roofing contractor	repalcement leadwork to parapet walls
Repairs to attic ceiling	none			

Q17. **Please give any further comments:**

Location Data

Location: (57.276092529297, -2.4488983154297)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Hopetoun House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☑ Building manager
- ☐ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2007

Q8. **Do you know who the previous owners, tenants or managers were?**

- ○ Yes (please specify name and contact details if known)
- ◉ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes - please visit our archive
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Varied access arrangements in varied roof spaces. V.few are fully safe and secure without preparation
- ○ No (please specify why)

Q12. **Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  Signs of previous woodworm, which is being monitored
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐	☐

Q13. **Please specify what the programmed works involve:**

None at present

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- (•) Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)	Annual	General check	roofer	Slate replacement
Repairs to flashings	Annual	General Check	roofer	mionor repair and sealing
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Location Data

Location: (55.949996948242, -3.1999969482422)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Innes House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [ ] Owner
- [ ] Tenant
- [x] User
- [x] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

May 2010

Q8. **Do you know who the previous owners, tenants or managers were?**

- ○ Yes (please specify name and contact details if known)
- ◉ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Specification and accounts for the 1996 renovation work.
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Don't know - many areas of the roof have not been accessed during my time here.
- ○ No (please specify why)

Q12. **Are the roof timbers visible?**

- (●) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [x] Roof covering (slates, lead, etc)
  Lead sheeting from the 1910 renovation has in places been worn to 'foil' thickness by dripping water, weather etc
- [x] Flashings
  Occasional repointing required
- [ ] Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☑	☑	☑	☐	☐	☐	☑	☑	☑
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☑	☑
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

Q13. **Please specify what the programmed works involve:**

Repairs

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- (●) No
- ( ) Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings	2014	Storm damage	Roofer	Repointing the flashings
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (57.13330078125, -2.1000061035156)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Kelburn Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☑ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

David Boyle and Lord Glasgow are the owners of the castle; contact via the Estate Office on 01475 568 685

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

We have worked at Kelburn Castle for around 20 years and have been in charge of various fabric repair projects over that period

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  The castle has always been in the ownership of the Boyle family
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  The castle archive is managed by a part-time archivist. We as architects have contract drawings relating to fabric repair projects
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Most of the roofspace areas are accessible or at least visible via ceiling access hatches
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Access varies from one part of the castle to another. The main tower roofspaces are partly accessible via stairs. Part of the tower roofspace may be viewable by access hatch but access into this space is not recommended due to age of timbers and no walkboards or lighting are provided. No access into tower corner turret roof voids.
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  Where access is available otherwise timbers not visible
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  Currently under repair to tower
- ☑ Roof covering (slates, lead, etc)
  Currently under repair to tower
- ☑ Flashings
  Currently being renewed to tower
- ☑ Attic ceiling
  Dry rot in tower bedroom

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☑	☑	☑	☐	☐	☐	☑	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☑	☑	☐	☐	☐	☑	☐
Programmed works to roof covering and flashings	☐	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

Renewal of leadwork; overhaul of slates; renewal of cast iron rainwater goods; chimneystack new cope stones; repair of harling; redecoration of harling; reforming lead flat roofs to falls to improve rainwater discharge; window repairs; rooflight renewal

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	2013-2016	rotten timbers	Contractor	repair & renewal of timber

Repairs to roof covering (slates, lead, etc)	2013-2106	loose & missing slates	Contractor	repair & renewal of slates
Repairs to flashings	2013-2016	leadwork defective, worn & patched	Contractor	replacement of leadwork
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Funding is a major problem in a building of this type as the owner has few financial resources so relies on grant aid from Historic Scotland which is in demand across the country and will only fund a % of the work, with the remainder needing to be found by the owner. As a result the repair projects are done in several phases and need to prioritise the most badly affected areas so that other areas have to be left until funds are available. This building is lived in by the owner but is used commercially as well and so repairs are often directed to areas which are required for commercial purposes ie attic level bedrooms

Location Data

Location: (55.966705322266, -3.61669921875)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Magdalen Chapel, Edinburgh

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

We are

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

We have owned the building since 1860.

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  The Edinburgh Hammermen
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  There is a good account in Book of Old Edinburgh Club (Vol. 8??); and Simpsons, the Edinburgh architects also have a lot of records.
- ( ) No

Q10. **Is the roof space of your building accessible?**

- ( ) Yes
- (•) Partly (please specify which parts are not accessible and why)
  The oldest part is accessible. Some of the nineteenth century parts may not be.
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- (•) Yes
- ( ) Partly (please specify what is missing)
- ( ) No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  Some of the timbers show signs of damp, but this not considered to be a current problem.
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

***Q13.* Please specify what the programmed works involve:**

Resolving whatever problem has been identified

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- (•) Yes
- ( ) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	1990s	don't know	Simpsons	
Repairs to roof covering (slates, lead, etc)	1990s	don't know	Simpsons	
Repairs to flashings	1990s	don't know	Simpsons	
Repairs to attic ceiling	1990s	don't know	Simpsons	

***Q17.* Please give any further comments:**

Please consult Simpsons for furthe details.

Location Data

Location: (57.143707275391, -2.0980987548828)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Malleny House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Building Surveyor in charge

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Approximately 8 years

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Other NTS Building Surveyors were responsible for the building maintenance before me including William Napier and Bryan Dickson. The NTS has owned the building and garden since 1968.
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Yes, accounts and drawings of later repair works
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  The roof space is accessible but there are rooms built into the roof so a lot of the roof structure is concealed behind wall linings.
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  The voids above the ceilings are not very big and there are no walking boards so access into the roofspace although possible isn't easy.
- ○

No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  As previous - rooms are built into the attic so much of the roof timbers are obscured by wall linings
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  Yes, roof timbers have been affected by insect attack although this is understood to be historic. Some roof timbers displaced. A structural engineer has inspected and believes the roof structure is in reasonable condition for it's age and type with only relatively minor repairs needed
- ☐ Roof covering (slates, lead, etc)
- ☐ Flashings
- ☑ Attic ceiling
  Damaged plaster nibs to lath & plaster ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☑	☐	☐	☐	☑	☐	☑
Inspection of roof structure (timbers and sarking)	☐	☐	☑	☐	☑	☑	☑	☐	☐	☐	☑
Programmed works to roof covering and flashings	☑	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	☑

***Q13.* Please specify what the programmed works involve:**

At the NTS we arrange annual inspections and minor maintenance of our roofs by a roofing contractor. We also have a programme of quinquennial surveys by a conservation accredited architect / surveyor / engineer to identify any repair needs and would programme the works thereafter. NTS surveyors also make regular visits to the properties and are in regular contact with the Property Managers to monitor repair need

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				

Repairs to roof covering (slates, lead, etc)	2011 and minor repairs annual	Repairs recommended in quinquennial survey and minor repairs identified during annual inspections	roofing contractor	Reslating localised areas
Repairs to flashings	2011	Repairs recommended in quinquennial survey	Roofing contractor	External fabric repairs including replacement of some lead flashing
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Location Data

Location: (55.932601928711, -3.2530975341797)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Maybole Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [ ] Owner
- [ ] Tenant
- [ ] User
- [x] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2003

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  David Gray Estate Office
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  Various old drawings and extensive accounts
- ( ) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ( ) Yes
- (•) Partly (please specify what is missing)
  Requires a ladder and caution walking on the floored areas
- ( ) No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  Previous fire in 1917 damp water ingress lack of heating in the building(now sorted)
- [x] Roof covering (slates, lead, etc)
  Slate nail sick
- [x] Flashings
  lead pointing
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☑	☐	☑	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

routine inspection cleaning gutters of pigeon muck replacing slates checking valley gutters and clean

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- (•) Yes
- ( ) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	2007	identified need	builder	cherry picker access
Repairs to roof covering (slates, lead, etc)	every 2 months	routine	builder	fix and repair
Repairs to flashings	every 2 months	routine	builder	check, fix and repair

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (55.75, -4.9499969482422)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Melville House monimail

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

December 2013

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  Jennifer Harvey
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ( ) Yes (please specify what documents you have)
- ( ) No

Q10. **Is the roof space of your building accessible?**

- ( ) Yes
- (•) Partly (please specify which parts are not accessible and why)
  All of roof space accessible
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ( ) Yes
- ( ) Partly (please specify what is missing)
- ( ) No (please specify why)

Q12. **Are the roof timbers visible?**

- ○ Yes
- ○ Partly (please specify where they are not visible and why)
- ○ No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☐ Structure (timbers and sarking)
- ☐ Roof covering (slates, lead, etc)
- ☐ Flashings
- ☐ Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q13. **Please specify what the programmed works involve:**

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ○ Yes
- ○ No
- ○ Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				
Repairs to attic ceiling				

Q17. **Please give any further comments:**

This question was not displayed to the respondent.

Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Methven Castle

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2005

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  My parents from 1984
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- (•) Yes (please specify what documents you have)
  Some but these are not listed or available for your use.
- ( ) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- (•) Yes
- ( ) Partly (please specify what is missing)
- ( ) No (please specify why)

Q12. **Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q13. **Please specify what the programmed works involve:**

Works are carried out on an as and when required basis. As an architect with knowledge of the building for in excess of 30 years an inspection, specification is produced by me.

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- (•) No
- ( ) Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	1984	defective timber	Contractor	Replacement and repair
Repairs to roof covering (slates, lead, etc)	1984	Defective sarking, demolition of adjacent building and slates thatdid not match	Contratcor	Slaterwork
Repairs to flashings	1984	as above	Contractor	Lead flashings
Repairs to attic ceiling				

Q17. **Please give any further comments:**

Location Data

Location: (56.399993896484, -3.4333038330078)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Prestonfield House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Project Manager

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2003

Q8. **Do you know who the previous owners, tenants or managers were?**

- ○ Yes (please specify name and contact details if known)
- ◉ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Some account books from 1680s, technical drawings from RCAHMS in 1943
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  Most covered by lath and plaster
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  floored but little visible structure
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  lath and plaster covers most
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☐ Structure (timbers and sarking)
- ☐ Roof covering (slates, lead, etc)
- ☑ Flashings
  Inevitable weak spots and need repairs
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐
Programmed works to roof covering and flashings	☐	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

Most recent has been some lead replacement

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (55.905197143555, -3.2005004882812)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Auld Hoose

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☑ Building manager
- ☐ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

1993

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  James Hamlton
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Documents may be held by the Archive Department
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Hatch access but no walkway or lighting
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- (•) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	1993 to date	water ingress	various	not known
Repairs to roof covering (slates, lead, etc)	1993 to date	water ingress	various	not known
Repairs to flashings	1993 to date	water ingress	various	not known
Repairs to attic ceiling	1993 to date	water ingress	various	not known

***Q17.* Please give any further comments:**

Location Data

Location: (57.143707275391, -2.0980987548828)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Caroline Park House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

25 dec 1987

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  Buccleuch Estates Limited
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ( ) Yes (please specify what documents you have)
- (•) No

Q10. **Is the roof space of your building accessible?**

- ( ) Yes
- (•) Partly (please specify which parts are not accessible and why)
  Yes partly excluding State appartments
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ( ) Yes
- ( ) Partly (please specify what is missing)
- ( ) No (please specify why)

Q12. **Are the roof timbers visible?**

- ○ Yes
- ○ Partly (please specify where they are not visible and why)
- ○ No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☐ Structure (timbers and sarking)
- ☐ Roof covering (slates, lead, etc)
- ☐ Flashings
- ☐ Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑
Inspection of roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑
Programmed works to roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑

Q13. **Please specify what the programmed works involve:**

regular maintenace

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ○ Yes
- ○ No
- ○ Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)	2015	storm damage	Mike Courtney	slates
Repairs to flashings				
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (55.949996948242, -3.1999969482422)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Sailor's Walk

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Building Surveyor

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

2001

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  John Young NTS Building Surveyor
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  Archaeological Reports and Surveys
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ○ Yes
- ◉ Partly (please specify what is missing)
  Access not available in all areas. No ladders, etc provided other than those on site.
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  Minor areas of decay and deflection
- [x] Roof covering (slates, lead, etc)
  Slates/Tiles
- [x] Flashings
  Lead/Mortar
- [x] Attic ceiling
  Plaster/Timber

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

maintenance, repairs and Inspection

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- (•) Yes
- ( ) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	c2005	Decay	NTS	Local repairs
Repairs to roof covering (slates, lead, etc)	Annual	Maintenance	NTS	Local repairs
Repairs to flashings	Annual	Maintenance	NTS	Local repairs

Repairs to attic ceiling	na	na	na	na

***Q17.* Please give any further comments:**

Location Data

Location: (55.63330078125, -3.1833038330078)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Tolbooth

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Admin

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Christabel Wandless, T: 01786 274003, E: wandlessc@stirling.gov.uk

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Have been part of the building staff sine 2003.

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  It has always been owned by the town council and thus maintained by their representatives or those that they let the building to.
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  The plans for the refurbishment in 2001, other documents are held in archives.
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  They may be all available to see, but as I'm not 100% sure will pick this answer.
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☐ Structure (timbers and sarking)
- ☐ Roof covering (slates, lead, etc)
- ☐ Flashings
- ☑ Attic ceiling
  We have had an ongoing issue with water coming in through the attic which is currently being dealt with.

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

***Q13.* Please specify what the programmed works involve:**

It would depend on the nature of the problem and probably a question best directed to Christabel.

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ◉ Yes
- ○ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				

Repairs to attic ceiling	This year	Water damage	Outside contractor	Ongoing

***Q17.* Please give any further comments:**

The exact nature of what is going on in the building should be best addressed to either Christabel Wandless or Alan Petrie, T: 01786 233240, E: petriea@stirling.gov.uk

Location Data

Location: (56.11669921875, -3.9499969482422)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Trades Hall, Glasgow

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☐ Architect in charge
- ☑ Other: Chief Executive

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

I am in charge along with the Hall Committee of Trades House

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

The Building has been owned by Trades House since it was built in 1794.

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  See last response
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  There are copies of various plans which show alterations made about ten years ago. These can be provided to you.
- ○ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [x] Structure (timbers and sarking)
  No problems
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

No programmed works - repairs carried out when required

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- (•) No
- ( ) Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)	2 years ago	Ingress of water	Not Known	Repairs to lead
Repairs to flashings	2 years ago ago	Ingress of water	Not Known	Repairs to lead
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (52.476806640625, -1.9340972900391)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Tron Theatre & Tron Steeple

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☑ Building manager
- ☐ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Billy Humes

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

Aprox.14 years December 2002

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Glasgow City Council
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ○ Yes (please specify what documents you have)
- ◉ No

Q10. **Is the roof space of your building accessible?**

- ◉ Yes
- ○ Partly (please specify which parts are not accessible and why)
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

Q12. **Are the roof timbers visible?**

- (•) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [x] Roof covering (slates, lead, etc)
  odd loose slate causing leaks but it is maintained
- [ ] Flashings
- [ ] Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Inspection of roof structure (timbers and sarking)	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐	☐

Q13. **Please specify what the programmed works involve:**

Replacing slates etc.

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- ( ) Yes
- ( ) No
- (•) Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)				
Repairs to roof covering (slates, lead, etc)				
Repairs to flashings				
Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (55.870803833008, -4.3056945800781)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Winton House

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- [x] Owner
- [ ] Tenant
- [ ] User
- [ ] Building manager
- [ ] Architect in charge
- [ ] Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

1996

Q8. **Do you know who the previous owners, tenants or managers were?**

- (•) Yes (please specify name and contact details if known)
  Parents
- ( ) No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ( ) Yes (please specify what documents you have)
- (•) No

Q10. **Is the roof space of your building accessible?**

- (•) Yes
- ( ) Partly (please specify which parts are not accessible and why)
- ( ) No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- (•) Yes
- ( ) Partly (please specify what is missing)
- ( ) No (please specify why)

Q12. **Are the roof timbers visible?**

- (●) Yes
- ( ) Partly (please specify where they are not visible and why)
- ( ) No (please specify why they are not visible)

Q13. **Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- [ ] Structure (timbers and sarking)
- [ ] Roof covering (slates, lead, etc)
- [ ] Flashings
- [ ] Attic ceiling

Q15. **Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐	☑
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☐

Q13. **Please specify what the programmed works involve:**

none at present other than routine maintenance. Replacement of lead roofs have been a rotational programme to completion 5+ years ago.

Q14. **Are reports given to you after the inspections/programmed works have been carried out?**

- (●) Yes
- ( ) No
- ( ) Sometimes

Q15. **Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	Ongoing	Resolution to a problem	Joiners and roofers	splicing timbers with timber or occasionally with steel
Repairs to roof covering (slates, lead, etc)	Annually	Slate replacement or lead works	roofer	replacement - like for like
Repairs to flashings	Ongoing	Where inadequate covering	Roofer or specialist lead worker	additional lead or replacement with shorter sheets
Repairs to attic ceiling	As and when needed	Ingress of water	Joiner, plasterer	replacement like for like

***Q17.* Please give any further comments:**

Property generally believed to be in good order. Whole house is used so problems tend to be spotted. Full-time caretaker with duties for property inspections and maintenance. I am a surveyor by profession and live at the property.

Location Data

Location: (55.962203979492, -3.2606048583984)

Source: GeoIP Estimation



Q1. **Thank you for taking part in this survey.**

It will take you less than 5 minutes!

Q4. **Please specify the name of the building:**

Yester house

Q5. **Please specify if you are the building owner, tenant, manager or architect in charge of the building's maintenance (please select all that apply):**

- ☐ Owner
- ☐ Tenant
- ☐ User
- ☐ Building manager
- ☑ Architect in charge
- ☐ Other:

Q6. **If you are not in charge of the maintenance of the building, please specify the name and contact details of who is in charge of the building maintenance:**

Sandy Stewart (eml sandystewart@yesterestate.com)

Q7. **Since when have you owned the building, lived in it or been in charge of the maintenance?**

We have been appointed as architects for the property since approx. Nov 2014

Q8. **Do you know who the previous owners, tenants or managers were?**

- ◉ Yes (please specify name and contact details if known)
  Gian Carlo Menotti (composer, now deceased)
- ○ No

Q9. **Do you have or know of any documents related to the building's original construction and later alterations (such as accounts, letters, drawings, etc), including recent repair works?**

- ◉ Yes (please specify what documents you have)
  We have many documents here. A full list of these can be provided on request
- ○ No

Q10. **Is the roof space of your building accessible?**

- ○ Yes
- ◉ Partly (please specify which parts are not accessible and why)
  The building has been heavily altered in the past, including the addition of an attic floor which is largely flat-roofed. Only certain sections of the original pitched roofs now remain and are accessible.
- ○ No (please specify why it is not accessible)

Q11. **Is the access easy (opening big enough for anyone to pass, well lit, walking boards provided, etc) and do you have the necessary equipment (ladders, torches, etc)?**

- ◉ Yes
- ○ Partly (please specify what is missing)
- ○ No (please specify why)

***Q12.* Are the roof timbers visible?**

- ○ Yes
- ◉ Partly (please specify where they are not visible and why)
  See previous.
- ○ No (please specify why they are not visible)

***Q13.* Are you aware of any current problems in your roof? Which parts are affected? Please select all the apply and specify what the problem is:**

- ☑ Structure (timbers and sarking)
  Several roof leaks occur during periods of heavy rain
- ☐ Roof covering (slates, lead, etc)
- ☑ Flashings
  The leaks appear mainly to relate to lead gutters and flashings. These are to be repaired during forthcoming refurbishment works.
- ☐ Attic ceiling

***Q15.* Do you have a regular maintenance regime for your roof? What parts of the roof are inspected, how often and by whom? What are your programmed works?**

	How often? Please select all that apply:					Who does the inspection/works? Please select all that apply:					
	every year	every 2 years	every 5 years	after a storm	when there seems to be a problem	an architect	an engineer	a surveyor	a roofing specialist	a general builder	myself
Inspection of roof covering and flashings	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐	☐
Inspection of roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐	☐
Programmed works to roof covering and flashings	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐	☐
Programmed works to roof structure (timbers and sarking)	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐	☐

***Q13.* Please specify what the programmed works involve:**

The property is soon to undergo a comprehensive programme of repair and refurbishment works.

***Q14.* Are reports given to you after the inspections/programmed works have been carried out?**

- ○ Yes
- ◉ No
- ○ Sometimes

***Q15.* Have repair works been carried out in the past? What parts of the roof have been repaired, when and by whom?**

	When?	Why?	By whom?	What did the repairs involve?
Repairs to roof structure (timbers and sarking)	1980s	Rot repairs	Not known	Not known
Repairs to roof covering (slates, lead, etc)	1980s	Failure	Not known	Complete renewal
Repairs to flashings	1980s	Failure	Not known	Complete renewal

Repairs to attic ceiling				

***Q17.* Please give any further comments:**

Location Data

Location: (51.514404296875, -0.094100952148438)

Source: GeoIP Estimation



APPENDIX C

INTERVIEWS TO THREE SCOTTISH CONSERVATION ENGINEERS

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ENGINEER 1

1. Where and what did you do your studies in?
I did a bachelor (4 years) in Civil Engineering in Dundee, then I got a PhD (3 years) studying new additives for concrete: it was an experimental research carried out on models in the laboratory.

2. Have you ever attended a course specific for conservation?
The University didn't offer any course on conservation. We did very little on masonry and on timber. I learnt what I know about conservation only when I started working for Historic Environment Scotland.

3. What are your previous professional experiences?
I worked for Jacobs Engineering, looking at marine structures and dealing mainly with concrete repairs (like grouting) for the first 8 months, then looking at existing bridges and calculating their capacity based on the surveys made by specialists (for about a year). I later passed to ARUP where I worked for 2 and a half years, designing new built mainly.

4. What is your current professional experience and how long have you been doing it for?
I now work for Historic Environment Scotland (HES) where I've been for the past 7 years.

5. What kind of projects do you normally work on?
We look at planning applications and take care of HES's 345 monuments. We deal with all sorts of structures and materials, even car parks and roads.

6. What is your role in these projects?
We deal with all the structural aspects.

7. If there is a team, what do the other members do?
We are three engineers in HES: one senior (John), myself, and an assistant (Franceska). Me and John deal mainly with the planning applications, Franceska does the surveys when necessary. Franceska's is a new post because before her we had a technician doing the surveying/drawing work. He had a lot of experience though, he was even better than a chartered engineer, so when he retired we could only replace him with an engineer.

8. Are you ever asked to inspect roof spaces and assess historic timber roof structures?
Yes, when the architects or the people from the Monuments Conservation Unit think there might be something wrong in the roof of a building they have surveyed they ask us to go and have a look. HES architects do a condition survey of our monuments every 2 or 3 years. The Monuments Conservation Unit people are instead based regionally so they go around the monuments all the time. If either of them sees something that they think might be a structural problem, they ask us to go and check it. This has happened for example in Tantallon Castle where a crack has been monitored with LVDT for 5 years now. We might be asked to inspect a roof even because an alteration is needed, for a change of use or something else. I haven't been dealing with historic timber structures so far though – they seem to be all in good condition.

9. Do you usually carry out any kind of preliminary investigation (such as historical research) prior to the inspection?
Yes, we do a desk survey prior to any visit, looking at the available data/documents related to the building.

10. What do you normally look out for during these inspections?
We look out for water ingress, which can come from the roof or the walls. It usually damages the end of the rafters. **What about the sarking?**
We always look at the sarking as well.
And open joints, deflections, deformations?
They are very rare.

11. Do you normally need to go back more than once?
After the desk survey we go on site, either me or John with Franceska, to see if any urgent intervention is needed. Then Franceska goes to carry out a more detailed survey, sometimes with the help of an architectural assistant.

12. Do you use any testing devices or do you simply carry out a visual inspection?
We sometimes use laser scanning but we use mainly traditional surveying techniques. Laser scanning is more useful for coastal protection, it is not reliable for detailed surveys. We tried to use it to monitor an intervention at the Great Hall at Stirling Castle, where we inserted steel ties because the lateral walls were opening. We found it to be not useful for engineering because it's not accurate enough to study deformations. So we use strain gauges instead at Stirling Castle. Laser scanning is good for big things, like changes in coasts, so we use it for that.
Do you usually monitor interventions you do?
Normally no, anything wrong with them is picked up by the architect's condition surveys. But for big things, like the Stirling Castle Great Hall, we monitor it ourselves.

13. Are you able to identify the different timber species and do you think it's an important part of the assessment?
It's important to know the timber species only if the element is of historical value. In that case we would call a wood specialist to identify the species and look at the condition of the timber. If not, we would just make assumptions.

14. In your experience, what problems are roof timbers normally affected by?
Water is always the main problem for timber. It usually damages the end of the rafters. Rot is the main issue, not deflections/deformations.
What about past interventions?
Also past interventions curing the symptoms rather than the causes can create more problems.

15. How do you take a decision on if and what kinds of repairs are needed?
We take a decision all together, me, John and Franceska. We call a timber specialist if we think there is active insect/fungi attack (if we see bore-dust or other similar symptoms). They do an inspection

and they propose the necessary treatment. In case of rot we cut out the rotten part and either replace it with a prosthesis connected with steel plates on the sides, or with an additional timber next to the original one bolted together. If the timber has no historical value we might even replace the whole element completely. If the timber is in contact with masonry we wrap the end of the timber to avoid humidity.

16. Do you do any calculations? By hand or with a computer modeling software?
We carry out hand calculations for simple elements and use modelling only in case of 3D structures. It is either me or John carrying out calculations.

17. How do you consider the timber resisting sections and mechanical properties?
We make assumptions.

18. What are the principles you follow when designing a repair intervention?
We follow conservation principles:

- Minimum intervention;
- Like for like;
- Honesty/distinguishability.

What do you mean with like for like in case of timber structures?
Like for like is valid for masonry structures, not for timber. We did replace a timber handrail like for like once (it was oak) and it lasted only for 2 years. I think the timber we have today is not as durable as the one used in the past. The architect can specify the species if he/she thinks it's important, but we only specify the strength.

ENGINEER 2

1. Where and what did you do your studies in?
In 1970 I graduated in civil engineering (BSC with honors) in Aberdeen. The first two years of the course were the same for all engineering. I didn't do a Masters because I wanted to go into industry and know more about the practical side and become a designer.

2. Have you ever attended a course specific for conservation?
During the three years of BSC there was no course on conservation or any aspect of history. It was all very much focused on mathematics. We had a design course only in our third year. There was no appreciation of the architectural and aesthetical aspect in any course. I learnt that later, during my professional experience, and also thanks to the collaboration with architects (in 1976 I did my first work with an architect).

3. What are your previous professional experiences?
Between 1970 and 1973 I worked at Taylor Woodrow civil engineering company in North England. We followed a project on 2 nuclear power stations. We also did a lot of temporary structures. There were many people with high practical and intellectual knowledge.
In 1975 I moved to Edinburgh to work in a smaller consultancy doing smaller engineering design projects: buildings rather than dams and power stations. All of my career has been about balancing between big and small things. This is important as there is a lot of difference in workmanship between big and small projects.
In 1976 I moved to Cuthbertson civil engineering, again in Edinburgh, designing dams for 7 years on and off. In between I left a bit because they were pushing me into management, which I didn't like at the time (I wanted to focus on design). I worked one year with a multidisciplinary team of engineers and architects who grew out of ARUP.
At that time I got my MICE (part III for engineers).
In 1982 I put up a practice in partnership with Peter Stephen, an engineer who was previously working with ARUP. We worked together up to 2000. There were 10 people in the team. We were working with architects for new buildings, but also started doing some conservation projects. We were heavily dependent on architects at that time, but I started wanting to do things on my own: this is the time when I started appreciating the management side of projects. That's why I eventually separated from Peter and created a new practice with Cristina. She joined us for an internship in 2000 - she was doing her Masters in York at that time. She went back to York to finish her Masters and then came back to form a new practice with me.

4. What is your current professional experience and how long have you been doing it for?
Me and Cristina started working together in 2000. She studied engineering/architecture in Poland and then did an architecture Masters in York.

5. What kind of projects do you normally work on?
We work a lot on ruins, doing stabilisation, consolidation, conservation of these ancient monuments. Mainly repairs, only rarely we do reuse/integration, because architects tend to deal with this aspect of projects. We almost never lead the projects, it's almost always architects, mainly for economic reasons. We also do pure engineering stuff, like bridges, and especially temporary works like scaffolding and management. Now for example I am following a project that deals with the movement of Aberdeen’s obelisk.

6. What is your role in these projects?
I deal with the structural aspects of the projects, but recently also with the management.

7. If there is a team, what do the other members do?
It's just me and Cristina. We do some works together, others separately, but we always ask for advice one to the other. I collaborate with architects sometimes.

8. Are you ever asked to inspect roof spaces and assess historic timber roof structures?
Yes, it can happen for different reasons. Sometimes we are called by a building owner who is worried about the ceiling/walls of the attic underneath: in that case we need to assess if there is a problem, and if there is one find a way to fix it. Other times there is an architect involved who wants to do something in the roof space or on the roof, and in that case we have to assess what kind of loads the roof structure can endure, if it can be altered and how it can be altered to obtain the desired intervention (for example to increase headroom). A roof inspection can also be necessary as part of a bigger project. The first thing in any case would be to discover if it's a listed building, so that we can advise the client what he is actually allowed to do. Even if the building is not listed, but the structure has a historic value, we would in any case advise to conserve it, and would fight against any action contrary to our advice.

9. Do you usually carry out any kind of preliminary investigation (such as historical research) prior to the inspection?
If we are in the lead role yes, but normally the architect is the "leader" and therefore he carries out the historical research. But often they don't actually look for things that are useful for the project itself, they focus more on historical facts, even unrelated to the actual fabric. So normally we have to integrate it.

10. What do you normally look out for during these inspections?
Firstly I try to get an overall impression of the roof. If the structure is in really bad conditions you can realize right away, because it will "feel" unsafe, shaky. I look for deflected rafters, failing struts, distortions, decay, rusting of nails. Elements that were meant to behave in a way, but are actually doing something completely different. I look at secondary elements like the sarking/boarding as well, because that's what makes it work in 3D, as a box. Even the nails between the sarking and the timbers are fundamental. I try to compare parts that are in good conditions with parts that are in bad conditions. I look at the section of the elements. I look at the ceiling underneath too.
How do you spot old decay and new decay?
There are always signs of recent decay/attack. Sticking a knife into the timber normally gives you an idea, but if the timber is heavily punctured I normally call the timber specialist to do some tests. In any case it's normally just about scraping all the bad timber off until you reach the good timber that is left. That is what we did in Verdant High Mill Museum: there were huge chunks of timber beams missing there because of decay – we just left them there because there is actually no load on the floor.

11. Do you normally need to go back more than once?
No if what is required is just an opinion on the value of the structure. Yes if there seems to be any problem. In this case the first inspection is only to organize access. You have to have some plaster removed most of the times to see parts of the structure that are not visible. If you can't, you have to adjust your report accordingly, and suggest in how much time the building should be inspected again, or if something should be monitored.

12. Do you use any testing devices or do you simply carry out a visual inspection?
I use moisture meters, and a spirit level and tape if I think that deflection is worth measuring.

13. Are you able to identify the different timber species and do you think it's an important part of the assessment?
Sometimes we take samples for the species identification. We call in a timber specialist. It's important to know the species for grounding of the project, but also because the deflections and the durability are proportional to the species. It's necessary to know the species also when a prosthesisation is needed, because you need to find a compatible piece of timber.
How would you connect a prosthesis?
I would glue it, or peg it, or screw it. It depends on the position of the prosthesis and the stresses. Many times it all depends on practicalities, like accessibility and safety. In the end it's down to

finding a way to do what you need to do without wrecking everything else. A big part of the work is making sure that you have enough resources to do what you need to do. In a recent project in Edinburgh and in another one in Fife we pushed a sagged ceiling and roof structure above back into position, and the client was enthusiastic about it. You can do it if you know what you're doing and if the client agrees. It's very quick and efficient but the hardest part is to convince people (contractors and clients) that it can actually be done.

14. In your experience, what problems are roof timbers normally affected by?
One of the biggest problems in roofs is normally decay and/or deflection in valley rafters caused by water ingress. Where there are valley rafters the structure is 3D, so it's very difficult to push the valley rafter back up as this would affect all the other members. Deflections are not always a problem: they are dangerous only if their shape shows that they are close to rupture, so if they are not "curved". Pushing the deflections back in place doesn't always work. They can also become a problem if they are not dealt with and other structures and parts of the building are built on top of them, increasing the charges.
Another common problem that roof structures have is notching made for cables, services, etc. A building in Marchmont (Edinburgh) where I worked had a 200mm notch into a 250mm beam! However, roofs are often saved by their redundancy: even though the situation looks bad it might be that the parts in good condition are enough to keep it safe. You need experience to be able to tell this.
15. How do you take a decision on if and what kinds of repairs are needed?
It depends very much on practicalities, such as access, etc.

16. Do you do any calculations? By hand or with a computer modeling software?
I do some basic hand calculations for some types of joints sometimes, and always in case of alteration because we have to prove that we comply with regulations and standards.

17. How do you consider the timber resisting sections and mechanical properties?
I assume average sections and average properties for the first calculations, then I adjust them based on the results I get. Timber in old buildings can sometimes be worse than you might think, especially if the timber used was homegrown in Scotland. In a Castle up near Forfar all floor joists were broken because the loads on them where high but mainly because the timbers were bad quality homegrown. Their sections were actually huge, so they shouldn't have deflected and broke as they did, but they did because they were made of very weak Scottish timber.
What if part of the section is missing inside, and you don't see it? How can you tell?
That will happen only if there is dry rot, which will be clearly visible. Even if the dry rot damage is old, you will have some kind of legacy of it. I saw that in many church roofs, as in the Church of the Sacred Heart in Lauriston Place in Edinburgh. There had been dry rot in the past but they thought they got rid of it – I closed the church and put scaffolds up and found that all the beams had been eaten up by dry rot. We then had moisture monitoring in for 15 years.

18. What are the principles you follow when designing a repair intervention?
If I had to choose 5 principles, I would say:
- minimum intervention (also because of costs);
- do no harm: you don't want to ruin what's around just because you think of stability only!
- easily reversible, but only for temporary works. There is no reason for permanent works to be reversible, unless you have a good reason for wanting it to be reversible;
- appropriate materials;
- distinguishability.
But I think the principles can be different based on the situation.

ENGINEER 3

1. Where and what did you do your studies in?
I studied Civil Engineering in Nottingham University, where I finished the Masters in 1997.

2. Have you ever attended a course specific for conservation?
The University didn't offer any courses in conservation. I could only take two modules out of the Civil Engineering department, so I took one in Architecture and one in Archaeology. Then I got a SPAB scholarship in 2005 and that's how I learnt about conservation. The scholarship is for building professionals, it lasts 9 months and is full-time. It's always on-site, visiting all sorts of conservation sites across the country, guided by professionals that are working there or have done the works there in the past. The first 6 months you follow practitioners, the last 3 months are spent in country houses. At the end you have to submit a report with sketches that you made on-site.
I'm the only conservation accredited engineer in Scotland, even though there are other engineers in Scotland who are experienced enough to be accredited.

3. What are your previous professional experiences?
I worked as a structural engineer in London for Alan Baxter & Associates for 10 years. They were doing some conservation work and that's why I got interested in conservation and decided to take a sabbatical year to do the SPAB scholarship.

4. What is your current professional experience and how long have you been doing it for?
I'm a Director in the Edinburgh practice of David Narro Associates since 2007.

5. What kind of projects do you normally work on?
We are not developers, we do mainly architect–led projects. 80% of the time we collaborate with architects, even because often the funders require an architect. In the case of Glasgow School of Art or St Cecilia's Hall, for example, we are working with Page & Park. The practice deals mainly with new built, but I work mostly on the existing: extensions, adaptations, refurbishment, consolidation. This includes modern concrete structures as well.

6. What is your role in these projects?
7. If there is a team, what do the other members do?
We are a total of 20 engineers here in the Edinburgh practice. Me and two others are directors. Everyone does a little bit of everything, we are all structural engineers. Many projects are never big enough to require more than one engineer to work on it.

8. Are you ever asked to inspect roof spaces and assess historic timber roof structures?
Yes.

9. Do you usually carry out any kind of preliminary investigation (such as historical research) prior to the inspection?
Usually the client provides that, or the architect. It's nice to know the history of the building before going on-site, but it's not always necessary.
But what about past repairs/loading history? Do you normally try to find out something related to that?
If others carry out a historical research, it is normally more factual, related to aesthetical/artistic aspects – so yes, I need to find out about past repairs myself.

10. What do you normally look out for during these inspections?
I look at the roof from outside first, to see if there are any holes, vegetation, water stains or other obvious things. I try to understand the complexity of the structure: if there are many valleys, many gutters, hidden gutters, etc. Weak areas to check are: joints between roofs, behind parapets, or in general where the geometry changes. Then I look at the condition inside: is there any water? How

does the timber look? Is there any infestation? Finally, I try to understand the performance of the roof structure, so I look if there are any distortions or deflections.

11. Do you normally need to go back more than once?

Yes, even though sometimes it's sufficient to take thousands of pictures.

12. Do you use any testing devices or do you simply carry out a visual inspection?

I use traditional techniques and sometimes coring (it leaves 5/8mm diameter holes) to check if the timber is sound inside. I call a timber specialist if there are large section timbers or signs of active infestation, like bore-dust - even though most infestations affect only the sapwood. It also depends on how big the building/contract is, because this influences the available funds.

13. Are you able to identify the different timber species and do you think it's an important part of the assessment?

I can distinguish between hardwoods and softwoods. I did a course at Weald & Downland open air Museum in Sussex to learn how to do Visual Strength Grading of hardwood timbers. It's important to know the species if you need to do any calculations.

14. In your experience, what problems are roof timbers normally affected by?

Roof timbers are mostly affected by water problems and rot, rather than distortions/deflections. You might find something broken or other failures, but generally speaking I find that rot is normally what triggers the other problems. Past interventions/alterations are often a problem as well.

Do you think poor initial design is often a problem?

Yes, it can happen. People think that since a roof has been there for a while it is been designed in an acceptable way, but sometimes it's not true. For example in the case of a project in Dunoon, there was a purlin roof with lots of purlins carried by sort of hammer-beam trusses that were not able to tie the walls together, which therefore started spreading quickly. Or in the case of another Victorian roof with scissor frames where the part of the rafters closer to the wall is highly stressed because the ties have been put at a higher level. In that case many later alterations/repairs contributed to the current problems as well.

Do you normally monitor interventions that you make?

Not formally, we just go back to check if we think it's necessary.

15. How do you take a decision on if and what kinds of repairs are needed?

It depends on many factors: what the client wants, if the building is listed or not, how much money is available, if you have a skilled carpenter available. You need a very skilled carpenter to do a good prosthesis, for example. Sometimes it's more about telling the carpenter what you want in terms of the structure, and let him decide how to solve the problem practically.

In the case of the Victorian roof I was talking about, the client wanted to get rid of the ties. We proposed to replace the whole roof, but it was too expensive. So we had to compromise: we are keeping the original timbers but putting new trusses so that the original structure is not loaded at all, it becomes redundant. Sometimes roofs are completely rotten, and look like they shouldn't be standing, but they actually do. In that case you close the building and prop the roof and then you have to do something even if you're not sure it's necessary. You have to stay on the safe side. That's valid also in the case of a roof which has been repaired many times in the past, like this Victorian roof, but still has problems.

16. Do you do any calculations? By hand or with a computer modeling software?

No, if it's clear what the problem is. Yes in case of a sensitive situation, such as a listed A building. But normally no, because it's too expensive to do too much analysis. The types of calculations depend on what you're dealing with. Loads in a roof can be indeterminate: you don't actually know what is happening. Sometimes you might conclude that a purlin is undersized if you apply all the loads: but maybe it's just providing extra resistance to wind pressure, in which case it wouldn't be undersized.

17. How do you consider the timber resisting sections and mechanical properties?

If I need to do calculations it is necessary to know the species. The problem is knowing the actual properties. A lot of testing will only give you a strength class, but nothing specific. So normally we look up reference tables for properties of different timber species. Often older timbers tend to be better. In the case of the Glasgow School of Art we had TRADA to identify the timber species and do Visual Strength Grading.

18. What are the principles you follow when designing a repair intervention?

- Simplicity
- Reversibility: because someone might think of a better way to do it in the future
- Traditional and tested materials/methods: I don't use innovative materials/techniques because I'm not sure they will work
- Distinguishability: for fool-proofing, so that someone who comes after you can see and understand what you did, and not destroy it creating structural problems

APPENDIX D

LIST OF POSSIBLE SOURCES OF INFORMATION ON SCOTTISH TIMBER ROOF STRUCTURES WHICH HAVE NOT BEEN CONSULTED

Surveys and reports by Addyman Archeology held at their office in The Old Printworks, 77a Brunswick Street, Edinburgh EH7 5HS

Ted Ruddock's slides held in Edinburgh University

John Adam's diary held at Blair Adam House

Extensive archives held at Blair Castle

Extensive archives held at Glamis Castle

Extensive archives held at Hopetoun House

Earl of Mar's drawings held at RIAS archives

APPENDIX E

STRUCTURED FORMS OF THE REFERENCE BUILDINGS

ABBEYSTRAND.....472
ARNISTON HOUSE.....476
AUCHINDINNY HOUSE.....482
AUCHINLECK HOUSE.....486
BALCASKIE HOUSE.....490
BLAIR CASTLE.....497
BRODIE CASTLE STABLES.....504
BRUSNTANE HOUSE.....508
COWANE'S HOSPITAL.....515
CRAIGSTON CASTLE.....519
CULROSS PALACE.....525
CULZEAN CASTLE.....529
DUFF HOUSE.....537
EDINBURGH PANMURE HOUSE.....542
FOUNTAINHALL HOUSE.....548
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HADDO HOUSE.....610
HOPETOUN HOUSE.....615
KELBURN CASTLE.....623
KINROSS HOUSE.....630
MALLENY HOUSE.....635
MAYBOLE CASTLE.....639
MELVILLE HOUSE.....643
METHVEN CASTLE.....652
OAKSHAW TRINITY CHURCH.....659
PILMUIR HOUSE.....663
ROBERT GORDON'S COLLEGE.....667
ROYSTON HOUSE.....671
SAILOR'S WALK.....681
STIRLING TOLBOOTH.....688

TWEEDDALE HOUSE.....694
YESTER HOUSE.....705

ABBEY STRAND

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)

X coordinate: 326796 Y coordinate: 673926

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC

Protection status: NATIONAL

HS Listing: A Rcahms ID: 124288

Original Use: Residential

Current Use: School

Freestanding ☐ N. of floors above ground level: 2 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

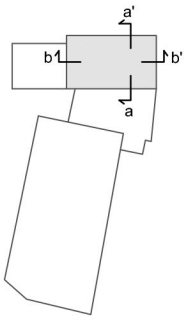
INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1475	1525	3 STOREYS TENEMENT TO WEST	BUILDINGS OF SCOTLAND COLLECTION
People involved:				
ADDITION, ALTERATION	1545	1555	WEST BUILDING RECONSTRUCTED AND EXTENDED TO NORTH	BUILDINGS OF SCOTLAND COLLECTION
People involved:				
ADDITION	1600	1625	L-SHAPED 2 STOREYS ADDITION ON SOUTH-EAST OF THE WEST BUILDING	BUILDINGS OF SCOTLAND COLLECTION
People involved:				
ALTERATION	1647		ROOF OF SOUTH EAST ATTIC	PICTURES GIVEN BY HS
People involved:				
ALTERATION	1800	1825	ADDITIONAL STOREY AND ATTIC TO WEST	HS
People involved:				
CONSERVRESTOR	1915	1916	WEST BUILDING	HS
People involved:				

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	
HANKE T.		☑	STRUCTURAL CARPENTRY AT ABBEYSTRAND, EDINBURGH	

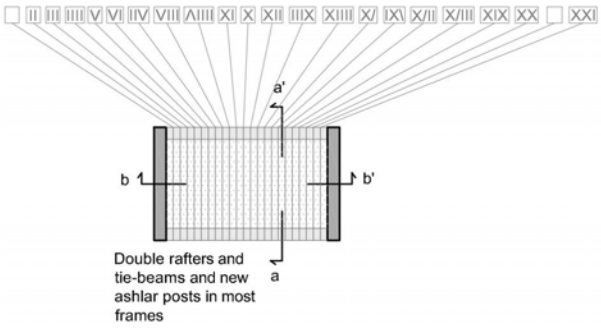
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

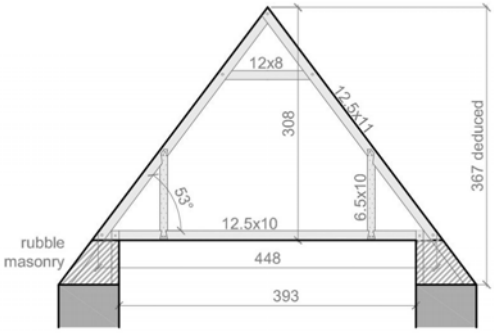
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

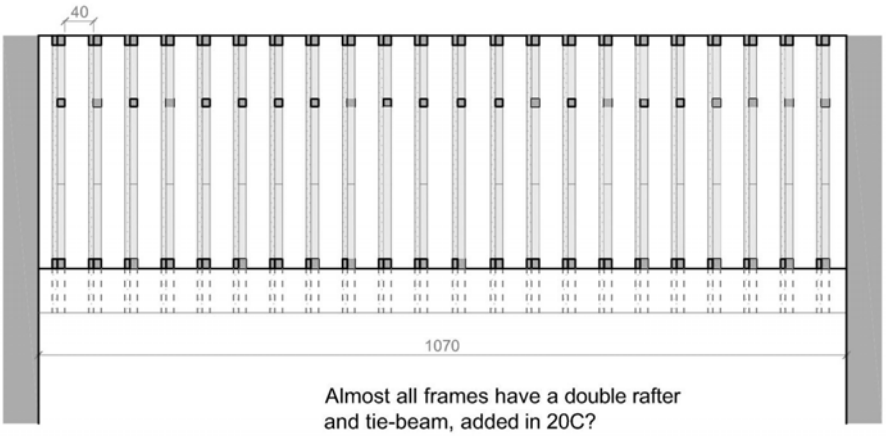
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** ABBEY STRAND | **Roof location** SE attic

Survey date(s) 08/09/2014 12/02/2016 | See drawing: AS-SE-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 3.9 | Roof Height [m]: 3.7

Roof Pitch/es [°]: 53 | Roof Length [m]: 10.7

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Masonry infill

Connection with gables:

Roof Construction Period: From 1630 To | Identified by: Estimated

Roof General Description:

Two-pitch gabled roof composed of closely spaced rafter couples connected transversally by two collars and longitudinally by sarking boards only. The collars are linked to the rafters also by a pair of vertical struts, probably added later since they are machine sawn and have notched dovetail joints. The rafters and collars are all whole logs roughly hand axed and joined with mortice and tenon joints secured by timber pegs. The connection with the wall is not well visible but there seems to be an ashlar post and rubble masonry infill in between the rafters. The frames are numbered with roughly sawn roman numerals

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 12.5 B: 11 | Or Purlin - H: | B:

Timber elements' Dressing: civil (machine-sawn), rustic (hand-axed), rustic | Bark ☑

Joint Types: dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

All mortice and tenon with timber pegs not flush. The ashlar posts have notched dovetail half lapped joints with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

They go from I to XXI. The trusses are 22, the first one has no visible marks and the last one has XXI on the collar, while frame XX has a new collar. The rest are in sequence.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:

Carried out by Anne Crone on the ceiling panels and beams and dated to 16th century



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation

Accessibility limitations

Past interventions: Most of the rafters and tie-beams doubled and ashlar posts added, probably all in the victorian period because it's machine sawn timber. Some sarking replaced.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

ARNISTON HOUSE

Location: MIDLOTHIAN | BORTHWICK
X coordinate: 332589 Y coordinate: 659467
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 53271

Original Use: Residential
Current Use: Museum, Residential

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1620			

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION, LANDSCAPE	1726	1733	ON FOUNDATIONS OF EARLIER HOUSE	HS

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐
ENZER	JOSEPH	PLASTERER	☐
DUNDAS	ROBERT LORD ARNIS	COMMISSIONERPATRON	☐
CALDERWOOD	SAMUEL	PLASTERER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1753	1755	WEST THIRD OF THE HOUSE, INTERIORS AND ORANGERIE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	JOHN	ARCHITECT	☑
DUNDAS	ROBERT LORD ARNIS	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1764		GARDEN HOUSE	

People involved:

Intervention type:	From:	To:	Description:	Reference:
LANDSCAPE	1791		GARDENS REDESIGNED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1800		CENTRAL PROJECTION ON GROUND STOREY AND DOUBLE STAIR TO GARDEN LEVEL	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1868		NEW LIBRARY ON GROUND FLOOR	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1872		PORCH	HS

People involved:

Last Name	First Name	Role	Attributed
WARDROP & REID		ARCHITECT	☐
WARDROP & REID		ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1875	1900	NORTH PEDIMENT REBUILT	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1950	1959	STEEL BEAMS AND WALLS IN WEST ATTIC	ROBIN KENT

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1980		RESLATED	OWNER

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1997			

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	210
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 39-44
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	39-44

ARCHIVAL REFERENCES

Archive	Doc.Num.	Folios
Royal Commission on the Ancient and Historical Monuments of Scotland	DPM 1940/110/4	7, 8, 12

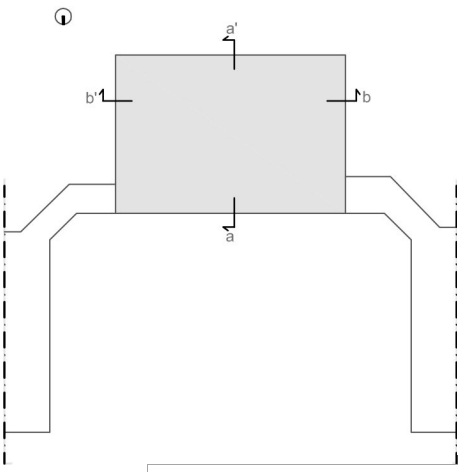
Title: Heating plans. Plans and details of West wing affected by dry rot. Plans, sections and details of roof.

Suggestions for further research: NRS: Dunda of Arniston papers (RH4/15) and plans (RHP5246 and RHP5248)

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

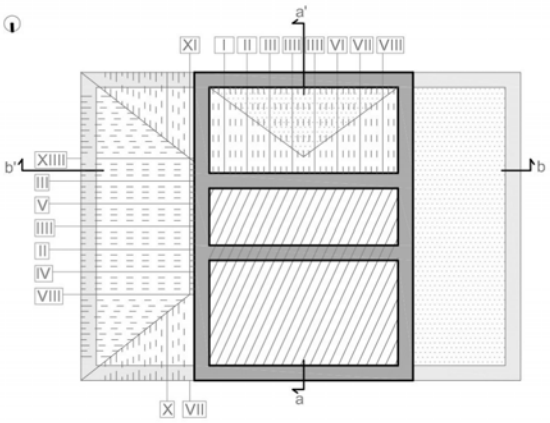
Archive	Royal Commission on the Ancient a	Doc. Num.	DPM 1940/110/4	Folios	7, 8, 12
Title	Heating plans. Plans and details of West wing affected by dry rot. Plans, sections and details of roof.	Date: from	1948	to	1952
Contents					
Summary and comments					



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

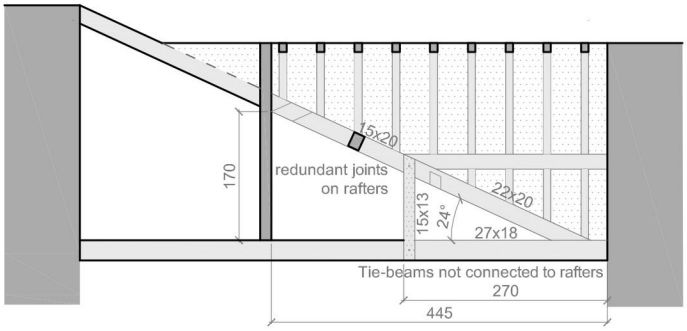
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'

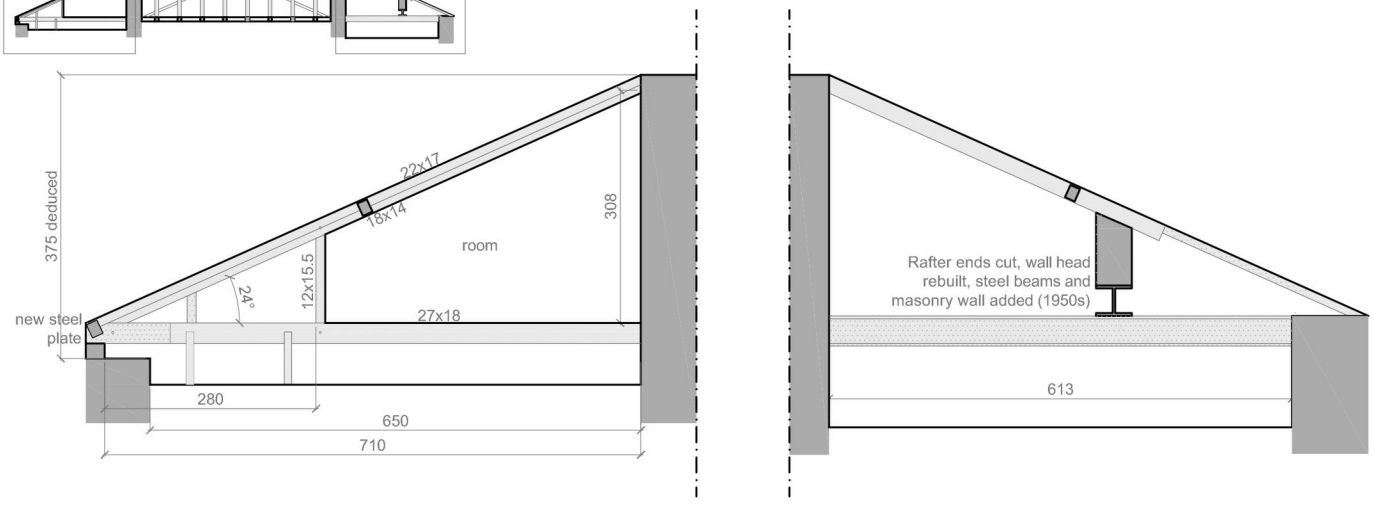


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** ARNISTON HOUSE | **Roof location** Main block

Survey date(s) 08/10/2014 | See drawing: ANH-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 6.5 | Roof Height [m]: 3.75

Roof Pitch/es [°]: 24 | Roof Length [m]: 29.1

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Other

Average Distance in between Primary Structure [m]: 1.5

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1726 To 1755 | Identified by: Estimated

Roof General Description:

A hipped platform roof with two transversal walls supporting the roof in both directions. Frames with tie-beam, rafter and vertical strut in-between. Upper part of structure not visible. 3 common rafters in-between the frames. Hand sawn timbers with big scantlings, joined by mortice and tenon joints. Big roughly sawn roman numerals marks some timbers; there are also some unusual carpentry marks. West side has been gutted in the 50s, almost nothing original remains. South side has pediment roof added in 19C.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 22 | B: 17 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber dowel, Timber wedge

Joints description:

All mortice and tenon with timber dowels flush. Vertical struts have timber wedges too.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description:

Roman numerals in sequence in central South part, not in sequence in East part.

Signs of reused timbers:

Redundant joints in rafters in South side, probably due to removed elements

Timber Treated ☐

Other Materials:

Steel beams and plates added in 1950s

Dendrochronology:



Roof structure: east | link I:\Arch\A



Roof Structure: center south | link I:\Arch\A



Connection with wall: east | link I:\Arch\A



Connection with wall: south | link I:\Arch\A



Carpentry marks and dressing | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation, presence of pigeons/wasps/bats

Accessibility limitations: Upper part of structure not visible.

Past interventions: Sarking replaced recently. Steel plates to reinforce tie-beams ends' in east side. West side almost completely gutted: rafter ends cut, wall head rebuilt, steel beams and masonry wall added (1950s).



Past interventions: east side | link I:\Arch\A



Past interventions: west side | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☐

Humdity stains on sarking

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

AUCHINDINNY HOUSE

Location	MIDLOTHIAN	LASSWADE	
X coordinate	325168	Y coordinate	661338
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PRIVATE		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	51853
Original Use	Residential		
Current Use	Residential		

Freestanding ☑ N. of floors above ground level 3 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1702	1707	FENWICK 1970 SAYS MAYBE THERE WAS AN EARLIER HOUSE FROM 16C	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT	☐
INGLIS OF LANGBYRES	JOHN	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1914	1920		

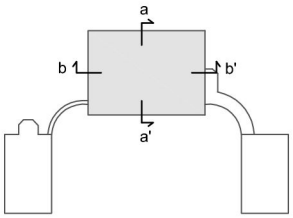
People involved:

Last Name	First Name	Role	Attributed
LEADBETTER & FAIRLEY & R		ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	85
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	120
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	12
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	16-17

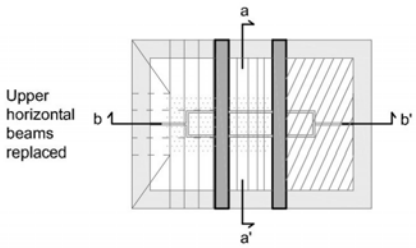
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

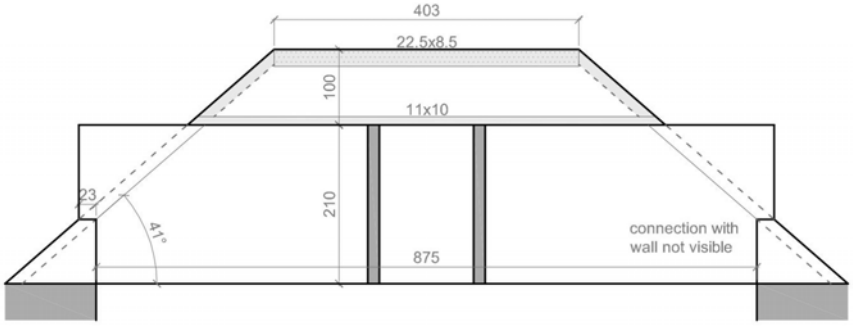
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

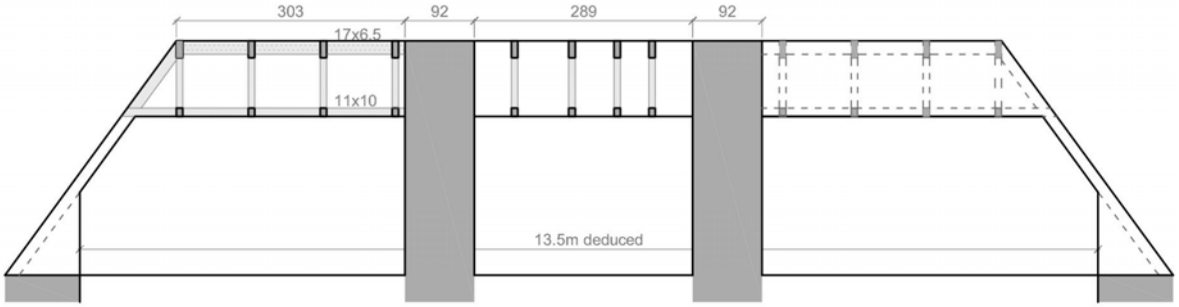
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** AUCHINDINNY HOUSE | **Roof location** Main block

Survey date(s) 07/07/2015 | See drawing: AYH-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 8.7 | Roof Height [m]: 3.1

Roof Pitch/es [°]: 41 | Roof Length [m]: 13.5

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Other

Average Distance in between Primary Structure [m]: 0.6

Type of Secondary Structure: purlins, sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 3

Connection with lateral walls: Unknown

Connection with gables: no gables

Roof Construction Period: From 1702 To 1707 Identified by: Estimated

Roof General Description:

Hipped platform roof divided in 3 sections by two transversal walls. Roof space between wallhead and collar beam plastered and occupied by bedrooms. Central section has 4 parallel frames composed of rafter couples connected transversally by an upper horizontal beam and a collar and longitudinally by sarking boards. East section has 4 frames running in the same direction as the ones in the central section, and 2 running perpendicular to these. West section not accessible. Connection with wall not visible.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: | B

Timber elements' Dressing: civil (machine-sawn), rustic (hand-axed), rustic | Bark ☐

Joint Types: lapped

Fasteners Types:

Joints description: All lapped - fasteners not visible

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof space used as bedrooms link I:\Arch\A



Roof structure from hatch link I:\Arch\A



Roof structure from hatch link I:\Arch\A



Joints: rafter and upper beam link I:\Arch\A



Joints: rafter and upper beam link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation

Accessibility limitations: Connection with the walls not visible. West section not accessible (there is no hatch). Other parts visible from hatch only, therefore not possible to closely inspect/measure

Past interventions: Upper horizontal beams seem to be more recent (they're machine sawn) - they might be contemporary to the early 20C rear addition



Past interventions: upper beam | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:		
Roof Damage				link	
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link

AUCHINLECK HOUSE

Location: EAST AYRSHIRE | AUCHINLECK
X coordinate: 250726 Y coordinate: 623016
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 43613

Original Use: Residential
Current Use: Hotel, Museum

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1755	1762	PRESENT MANSION ATTRIBUTED TO ROBERT ADAM	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	ROBERT	ARCHITECT	☑
LORD AUCHINLECK	ALEXANDER BOSWEL	COMMISSIONERPATRON, DESIGNER	☐
JOHNSTON	JOHN	WRIGHT	☐
BOWIE	JAMES	SLATER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1774		4 WINGS	LANDMARK TRUST

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1986	2001		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
SIMPSON & BROWN		ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
SURVEY	2000			CANMORE

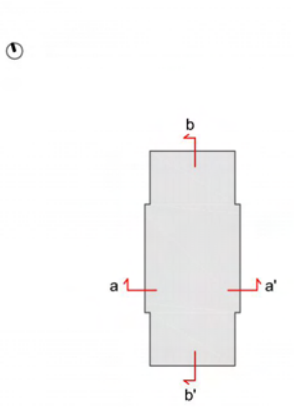
People involved:

Last Name	First Name	Role	Attributed
ADDYMAN ARCHAEOLOGY		ARCHAEOLOGIST	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CLOSE R.	2012	☐	THE BUILDINGS OF SCOTLAND COLLECTION: AYRSHIRE AND ARRAN	
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME III. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	496-497
STANFORD C.	2001	☑	AUCHINLECK HOUSE - HISTORY ALBUM	

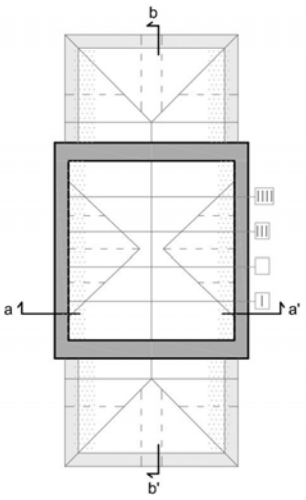
Suggestions for further research: NRS: drawings of late 18th century and 1978 (RHP23133 and RHP38293)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

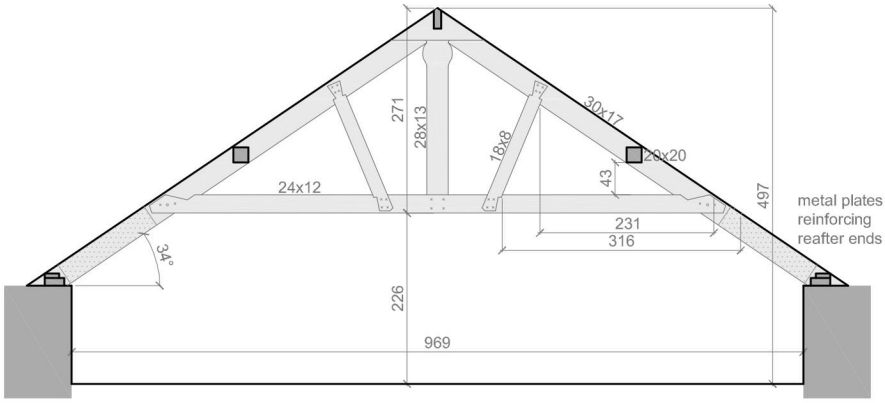
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

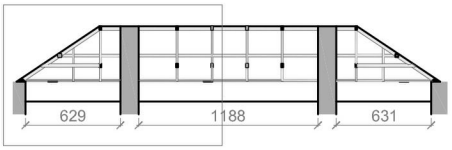
Section aa'

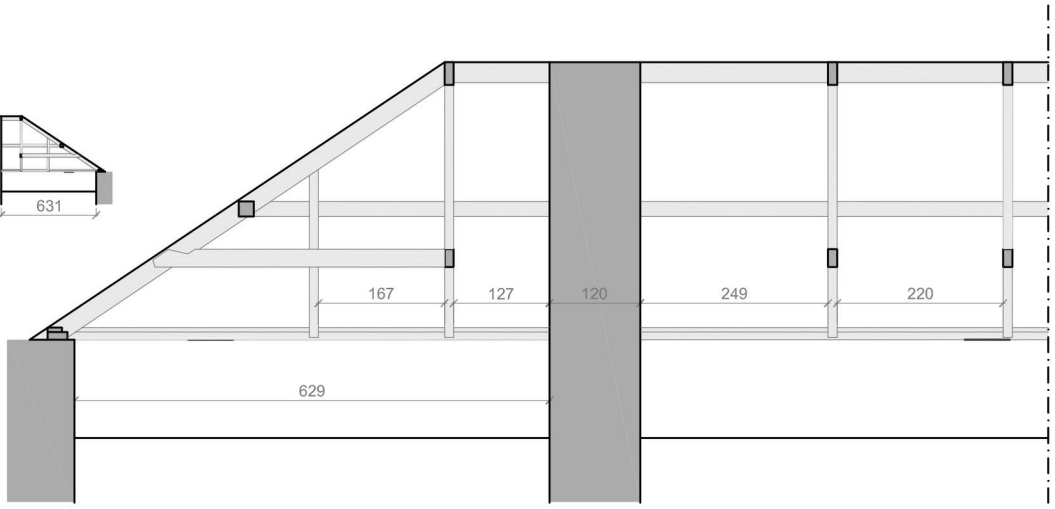


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** AUCHINLECK HOUSE | **Roof location** Main block

Survey date(s) 29/09/2014 | See drawing: AKH-MB-1

Roof Geometry: hipped

Roof Max Span [m]: 9.7 | Roof Height [m]: 5

Roof Pitch/es [°]: 34 | Roof Length [m]: 26.8

Type of Primary Structure: 2D framing

Truss ☑ KING-POST

Frame ☐

Average Distance in between Primary Structure [m]: 2.25

Type of Secondary Structure: common rafters, purlins, sa | Plane: horizontal, roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1755 To 1762 | Identified by: Estimated

Roof General Description:

A hipped roof with two transversal walls: central block with four trusses and cross roofs from the two pediments; side blocks with one truss and hip rafters. Trusses have a raised tie-beam and a king-post in tension with diagonal struts. They are connected by butt-purlins, one on each side. The cross roofs from the pediments are supported by 3 purlins and common rafters. The pitch is quite low. The attic spaces were used as rooms: remains of panels and nails can be seen under all rafters and tie-beams, and there are fireplaces.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 30 | B: 17 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: bulb shaped joggle, cleat, dovetail, joggle, lapped, mortice and teno

Fasteners Types: Metal nail, Timber peg flush

Joints description:

Rafters apex: mortice and tenon with rounded joggle; between raised tie-beam and post: half lapped with iron nails; All others are dovetail notched lapped with iron nails. The joints between raised tie-beam and rafters also have timber pegs.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description:

Numbered from I to IIII from south to north (number II isn't visible).

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology



Roof Structure | link I:\Arch\A



Roof Structure | link I:\Arch\A



Joints: rafter and raised tie-beam | link I:\Arch\A



Joints: post and raised tie-beam | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Wall heads rebuilt and some timbers replaced, mainly common rafters, purlins and sarking. Steel plates added to the strengthen the rafters ends. Insulation and partition added.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

BALCASKIE HOUSE

Location FIFE | CARNBEE

X coordinate 352465 Y coordinate 703582

Geogr. Referencing System BRITISH NATIONAL GRID





Property status PRIVATE

Protection status NATIONAL

HS Listing A Rcahms ID 34206

Original Use Residential

Current Use Residential

Freestanding ☑ N. of floors above ground level 3 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1629		3 STOREY L-PLAN HOUSE. MAIN BLOCK STILL VISIBLE ON THE SOUTH, WHERE IT OCCUPIES THE WEST THIRD OF THE FRONT	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1668	1674	INCORPORATED ORIGINAL L PLAN HOUSE (HEIGHTENED IT TO 4 STOREYS) TRANSFORMING IT INTO A U PLAN	CANMORE

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT, COMMISSIONERPATRON	☐
HAMILTON	JOHN	MASON	☐
SCOTT	ALEXANDER		☐
WALLACE	ARCHIBALD		☐
DUNSTERFIELD	GEORGE	PLASTERER	☐
DE WET	JACOB	PAINTER	☐
PATERSON	ALEXANDER	WRIGHT	☐
WADDELL	ANDREW	WRIGHT	☐
BAINE	JAMES	MATERIAL SUPPLIER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1745	1755	REMOVED OFFICE BUILDINGS AND REPLACED THEM WITH PAVILIONS JOINED TO THE HOUSE; CENTRE BLOCK LARGELY REBUILT AND RAISED TO 3 STOREYS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1830	1832	JACOBEAN PORCH ADDED, LOWERED SILLS ON SOUTH FRONT AND INTRODUCED AN IRON BALCONY ACROSS THE MAIN BLOCK TO THE REAR; TWIN GABLED EAST ADDITIONS AND WEST STABLE BLOCK	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BURN	WILLIAM	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1856	1858	ORIEL TO SOUTHWEST TOWER AND BARONIAL ADDITIONS TO WEST ELEVATION	BUILDINGS OF SCOTLAND COLLECTION

People involved:

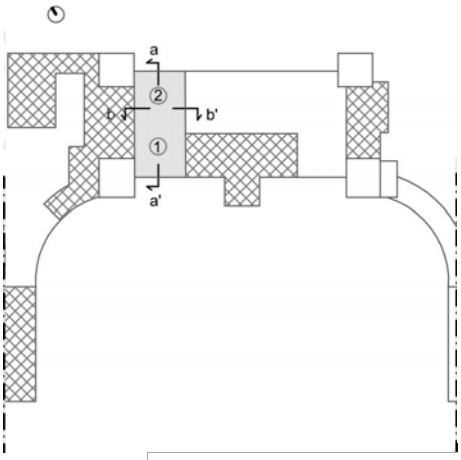
Last Name	First Name	Role	Attributed
BRYCE	DAVID	ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	77
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	119

Author	Year	Unpubl.	Title	Pages
GIFFORD J.	1988	☐	THE BUILDINGS OF SCOTLAND COLLECTION: FIFE	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	78
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	12
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	10

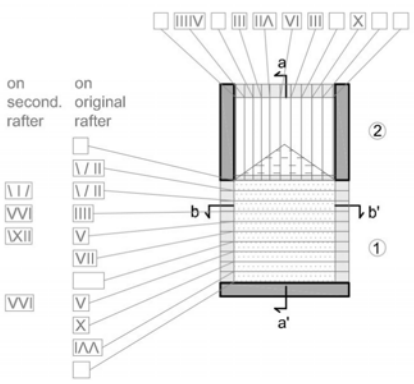
Suggestions for further research	Owner has 3D laser scan of house St Andrews University Library Department of Special Collections: Papers of the Anstruther family of Balcaskie (GB227/msdep121)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



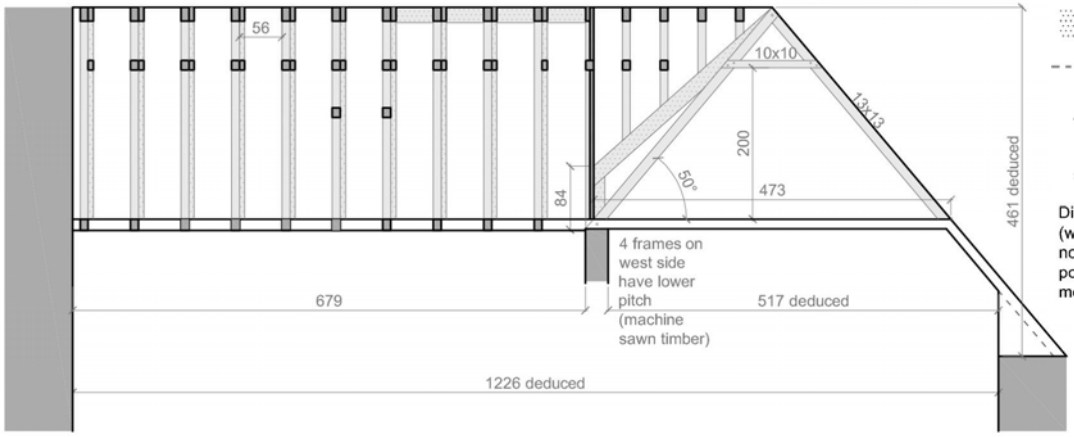
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

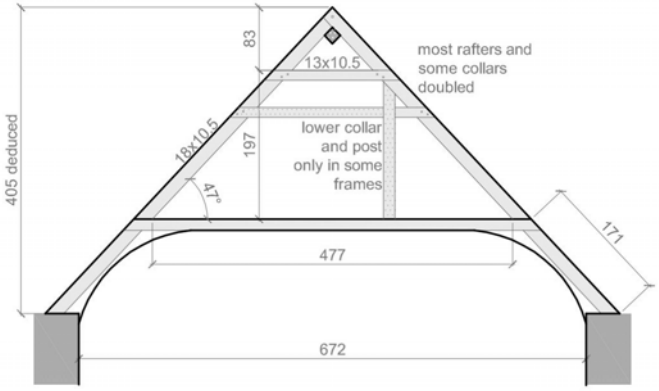
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section aa': Roof 2



Section bb': Roof 1



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** BALCASKIE HOUSE | **Roof location** 1: NE corner of main block

Survey date(s) 12/09/2014 | See drawing: BCH-W-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 6.7 | Roof Height [m]: 4

Roof Pitch/es [°]: 47 | Roof Length [m]: 6.8

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.55

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: None

Connection with gables:

Roof Construction Period: From 1668 To 1674 | Identified by: Estimated

Roof General Description:

Two gabled roofs intersecting one another. Roof 1 is composed of closely spaced rafter couples connected trasversally by two or three collars (some collars have been added later) and longitudinally by sarking boards only. The timbers are all full logs roughly hand axed. The rafters simply sit on the wall-head. The frames have been doubled, maybe in the 18th century. The sarking is not visible because insulation panels have been placed between the rafters. To the West is a 19C roof.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 18 | B: 10.5 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: mortice and tenon with timber pegs. Between collars and rafter: lapped with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description:

Roman numerals not in sequence and not every frame has one.

Signs of reused timbers: three rafters have redundant joints

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure: south side | link I:\Arch\A



Connection with wall | link I:\Arch\A



Dressing & carpentry marks | link I:\Arch\A



Signs of reused timber | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☑

Decorative features

Unfavourable conditions: poor ventilation, presence of pigeons/wasps/bats, presence of water tank

Accessibility limitations: Connection with the wall and raised tie-beam only partly visible. Side of rafters and sarking not visible due to insulation panels.

Past interventions: Double rafters and collars added (maybe in 18C). Ridge beam and some lower collars added, as well as insulation panels (20C?). Water tank placed above the new collars.



Past interventions link I:\Arch\A



Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Insect attack link I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: link I:\Arch\A

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: link I:\Arch\A

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link I:\Arch\A

INITIAL SURVEY | **Building name** BALCASKIE HOUSE | **Roof location** 2: NE corner of main block

Survey date(s) 12/09/2014 | See drawing: BCH-W-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.2 | Roof Height [m]: 4.6

Roof Pitch/es [°]: 50 | Roof Length [m]: 6.7

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.6

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables

Roof Construction Period: From 1668 To 1674 | Identified by: Estimated

Roof General Description: Two gabled roofs intersecting one another. Roof 2 is composed of closely spaced rafter couples connected trasversally by two collars and longitudinally by sarking boards only. The timbers are all full logs roughly hand axed. The connection with the wall is not visible. The sarking is not visible because insulation panels have been placed between the rafters. There are some unusual carpentry marks.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 13 | B: 13 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Rafters' apex: mortice and tenon with timber pegs. Between collars and rafter: lapped with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description: Roman numerals not in sequence and not every frame has one.

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology



Roof structure: north side | link I:\Arch\A


Connection with wall in intersection | link I:\Arch\A


Timber elements' dressing | link I:\Arch\A


Joints: rafter and collar | link I:\Arch\A


Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☑

Decorative features

Unfavourable conditions: poor ventilation, presence of pigeons/wasps/bats

Accessibility limitations: Connection with the wall not visible on north side. Tie-beam not visible. Side of rafters and sarking not visible due to insulation panels.

Past interventions: Double rafters and collars added (maybe in 18C). Lower pitch added (18C?). Insulation panels added (20C?).



Past interventions link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:	
Roof Damage				link
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link I:\Arch\A

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link I:\Arch\A

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link I:\Arch\A

BLAIR CASTLE

Location: PERTH AND KINROSS | BLAIR ATHOLL
X coordinate: 286577 Y coordinate: 766186
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 25802

Original Use: Residential
Current Use: Hotel/Inn, Museum

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1296			HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1500		ORIGINALLY A 16TH CENTURY TOWER HOUSE, ALTERED AT DIFFERENT PERIODS.	HES LISTING

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1500	1525	CENTRAL PART	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1617		DATED STONES 1617	HES LISTING

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1629	1650	SOUTH, BUT NEVER COMPLETED DUE TO CIVIL WARS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
MURRAY	JOHN 2ND EARL & 1S	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1668		DATED STONES 1668	HES LISTING

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1700		18TH CENTURY EAST WING	HES LISTING

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1736		SOUTH END RAISED	HS

People involved:

Last Name	First Name	Role	Attributed
DOUGLAS	JOHN	ARCHITECT	☐
MURRAY	JAMES 2ND DUKE OF	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1743	1745	2 STOREY SOUTH EAST WING	HS

People involved:

Last Name	First Name	Role	Attributed
WINTER	JAMES	ARCHITECT	☐
MURRAY	JAMES 2ND DUKE OF	COMMISSIONERPATRON	☐
ADAM	WILLIAM	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1745		BESIEGED AND CANNONATED: ALL REROOFED	

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1747	1758	TOWERS LEVELLED TO COMMON WALL HEAD, ANGLE	HS

TURRETS REMOVED, S. END REBUILT AND COMPLETED

People involved:

Last Name	First Name	Role	Attributed
CLAYTON	THOMAS	PLASTERER	☐
SWAN	ABRAHAM	JOINER	☐
DOUGLAS	JOHN	ARCHITECT	☐
WINTER	JAMES	CONTRACTOR	☐
CHESSELS	ARCHIBALD	JOINER, WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1814		FIRE IN SOUTHEAST WING	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1869	1871	REBARONIALISED: ESIGN OF WEST FRONT APPROXIMATELY BASED ON ORIGINAL WITH CUMMING'S TOWER WIDENED BY CORBELLING, ENTRANCE HALL ADDED ON EAST SIDE, THAT SIDE BEING LARGELY REDESIGNED ANEW	HS

People involved:

Last Name	First Name	Role	Attributed
BRYCE	DAVID	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1876	1877	BALLROOM	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1886			HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1893		1893 NORTH WING AND RE-FRONTING OF EAST RANGE BY THOMAS LEADBETTER	HES LISTING

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1920	1921		HS

People involved:

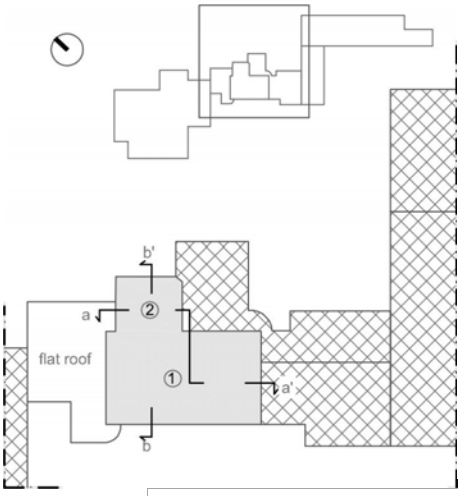
Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1990	1999	SARKING AND SLATES REPLACED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	240-244
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	20, 51, 103, 104
GIFFORD J.	2007	☐	THE BUILDINGS OF SCOTLAND COLLECTION: PERTH AND KINROSS	

Suggestions for further research: Extensive archive material at the castle

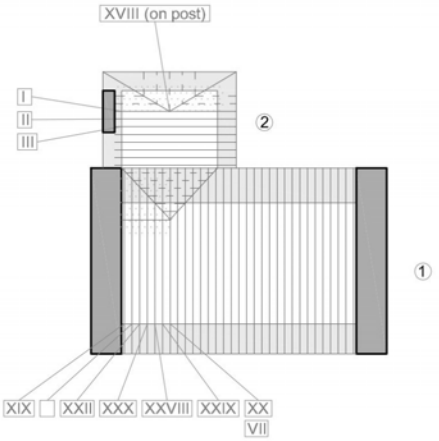


Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Legend (plans):

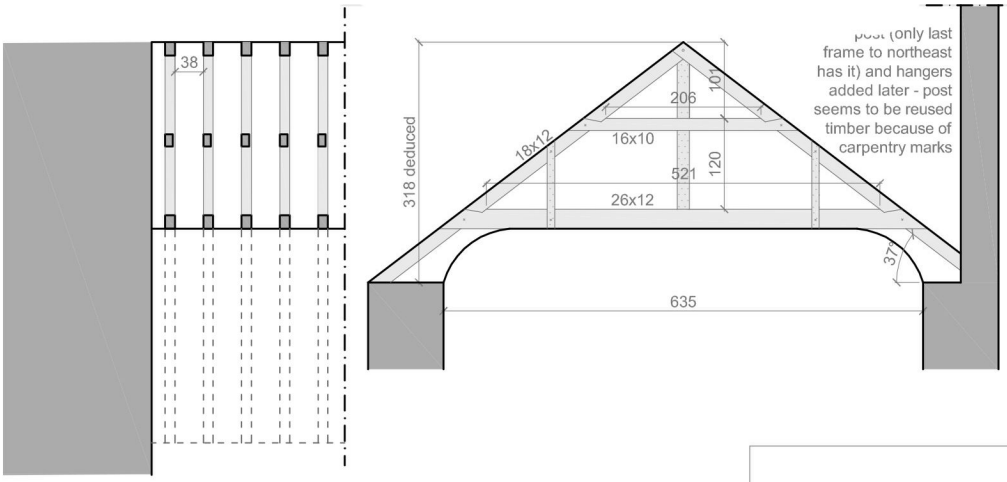
Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

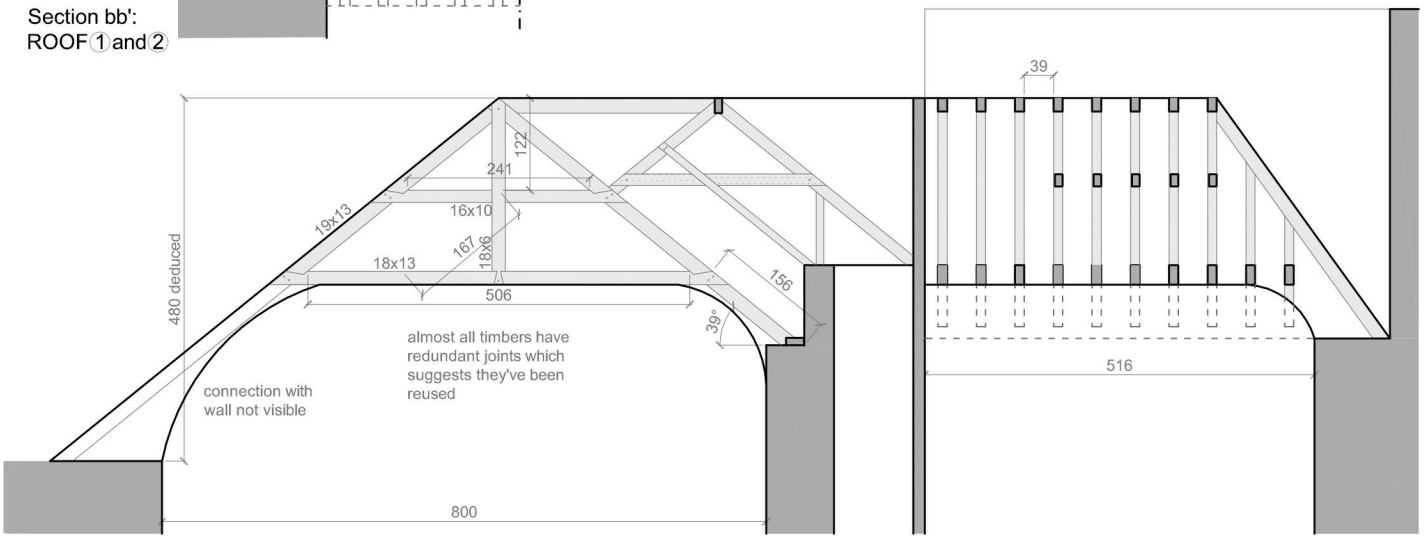
Section aa':
ROOF ① and ②



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb':
ROOF ① and ②



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof 1 from outside I:\Arch\A



Roof 2 from outside I:\Arch\A

INITIAL SURVEY | **Building name** BLAIR CASTLE | **Roof location** 2: E part of central block

Survey date(s) 04/08/2015 | See drawing: BLC-W&E-1

Roof Geometry: Hipped, Two-pitch gabled with intersections

Roof Max Span [m]: 6.35 | Roof Height [m]: 3.18

Roof Pitch/es [°]: 37 | Roof Length [m]: 5.16

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, King-strut

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1745 To | Identified by: Estimated

Roof General Description:

Hipped roof intersecting roof 1 to South-East. Composed of closely spaced rafter couples connected trasverally by two collars (except for 3 frames on South-West side which have only one lower collar) and longitudinally by sarking boards only. Some frames have vertical struts too. The rafters simply sit on the wall-head. The timbers are numbered with two sets of roman numerals, some big and sawn, other small and chiselled.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 18 B: 12 | Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: lapped with timber peg not flush. Between collars and rafters dovetail lapped with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, small chiseled roman numerals

Carpentry Marks Description:

Signs of reused timbers: More than one carpentry mark on post - probably reused

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not well visible.

Past interventions: Sarking replaced. Some rafters reinforced with timber.



Past interventions | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** BLAIR CASTLE | **Roof location** 1: W part of central block

Survey date(s) 04/08/2015 | See drawing: BLC-W&E-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 8 | Roof Height [m]: 4.8

Roof Pitch/es [°]: 39 | Roof Length [m]: 15.6

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, King-strut

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown, Wall-plate

Connection with gables:

Roof Construction Period: From 1745 To | Identified by: Estimated

Roof General Description: Gabled roof intersecting roof 2 to North-West. Composed of closely spaced rafter couples connected trasverally by two collars and longitudinally by sarking boards only. All frames have vertical struts too. The connection with the wall is visible only on the North-West side: the rafters simply sit on the wall-head. The timbers are numbered with two sets of roman numerals, some big and sawn, other small and chiselled.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 19 | B: 13 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Rafters' apex: lapped with timber peg not flush. Between rafters and collars: dovetail lapped with two metal nails. Hanger is nailed only at the top, but dovetail lapped with metal nail at the bottom.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, small chiseled roman numerals

Carpentry Marks Description:

Signs of reused timbers: A lot of redundant joints on almost all timbers: mortice and tenon, lapped, and very strange lapped ones with curved shape.

Timber Treated ☐

Other Materials: Steel

Dendrochronology: Coralie Mills carried out dendrochronolgical analysis on some roof timbers - need to ask her



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: lower collar and strut | link I:\Arch\A



Redundant joints | link I:\Arch\A



Joints, carpentry marks, reused | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: Original plaster ceiling underneath

Unfavourable conditions: poor ventilation

Accessibility limitations: Connection with wall not visible on southwest side

Past interventions: Sarking replaced. Stell brackets and timber reinforcing some rafters. Some new collars.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Insect attack in some timbers, not sure if active

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes: Many redundant joints that suggest the timbers have been reused. The 1745 date is only estimated: the castle was besieged and cannonated at this date and it seems it had to be completely reroofed (this is what the archivist says). They might have reused the timbers from the previous 16C roof. Need to have a look at archives at the castle.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

BRODIE CASTLE STABLES

Location	MORAY	DYKE AND MOY	
X coordinate	297871	Y coordinate	857803
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PUBLIC		
Protection status	NATIONAL		
HS Listing	B	Rcahms ID	171454
Original Use	Stables		
Current Use	Meeting Hall		

Freestanding ☑ N. of floors above ground level 2 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1775	1800	NOT ON ESTATE PLAN OF 1770. BUILT AROUND GABLE WALL OF AN EARLIER STRUCTURE (REMAINS VISIBLE IN THE NW GABLE).	ADDYMAN REPORT 2000

People involved:

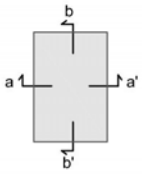
Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1845	1855	THE EARLY NW RANGE WAS TO BE REPLACED BY A SCOTS BARONIAL TOWER AND THE STABLES REMODELLED. THE EARLY NW RANGE WAS DEMOLISHED AND THE CENTRAL POSTS OF THE STABLES ROOF WERE REMOVED. ARCHES WERE INFILLED AND BUTTRESSES WERE ADDED.	ADDYMAN REPORT 2000

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
ADDYMAN & KAY LTD	1999	☑	THE OLD STABLES, BRODIE CASTLE - MORAYSHIRE - AN ARCHITECTUI RECORD AND ANALYSIS FOR THE NATIONAL TRUST FOR SCOTLAND	
CRONE A. & MILLS C.	2011	☐	THE NATIVE OAK AND PINE DENDROCHRONOLOGY PROJECT – AND S OBSERVATIONS ON TIMBER AND WOODWORKING IN SCOTTISH BUIL C.1450–1800	
WALKER D. & WOODWORTH M.	2015	☐	THE BUILDINGS OF SCOTLAND COLLECTION: ABERDEENSHIRE: NORT MORAY	

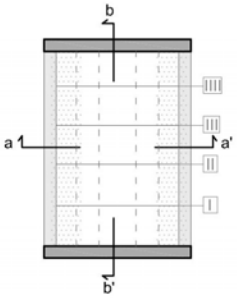
Suggestions for further research: Collection of papers at Brodie Castle in Nairn: online catalogue can be found at NRS website (search NRAS770)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

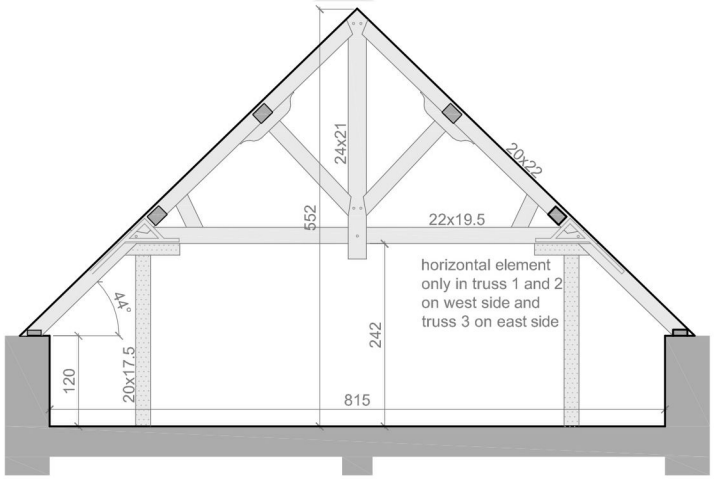
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

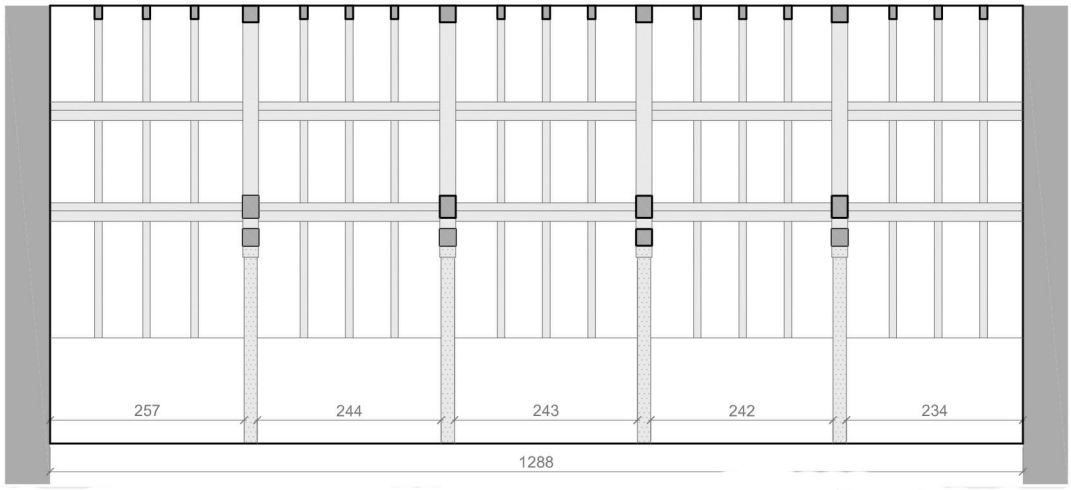
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** BRODIE CASTLE_STABLES | **Roof location** Stables

Survey date(s) 05/09/2014 | See drawing: BRC-S-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 8.1 | Roof Height [m]: 5.5

Roof Pitch/es [°]: 44 | Roof Length [m]: 12.9

Type of Primary Structure: 2D framing

Truss ☑ KING-POST

Frame ☐

Average Distance in between Primary Structure [m]: 2.4

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: purlins

Roof Construction Period: From 1775 To 1800 Identified by: Estimated

Roof General Description: Gabled roof with 4 king-post trusses supporting butt-purlins, common rafters and sarking boards. The trusses have a collar, two pairs of slanted struts (with cleats) and two purlins on each side. Two lateral posts and metal straps have been added later. The collar ends have also been partly replaced with prostheses. The rafters simply sit on the wall-head. The king-post curiously overlaps the collar and continues beneath it with a short stump. The frames are numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square

Rafter Scantling [cm] H: 20 B: 22 Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: cleat, dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal nail, Metal strap, Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush except for the joint between collar and rafters which is dovetail lapped with timber pegs and metal stripes that have been added later. The post has notches at the top and bottom for the rafters and the struts.

Wood Species: pine (Crone & Mills 2011) | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Numbered from I to IIII from south to north. There is a big X on the rafter end of truss 1 and 2

Signs of reused timbers:

Timber Treated ☐

Other Materials: Metal straps in joint between rafter and raised tie-beam

Dendrochronology: dendrochronology not doable.



Roof Structure link I:\Arch\A



Connection with wall link I:\Arch\A



Joints: king-post link I:\Arch\A



Joints: rafter and raised tie-beam link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☐ Insulation on sarking ☑

Decorative features

Unfavourablec onditions

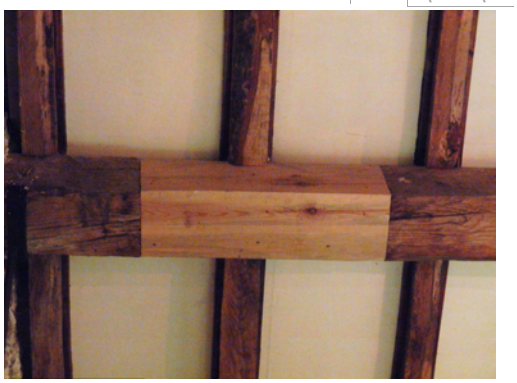
Accessibility limitations

Past interventions

Lateral posts and metal straps in the joints between raised tie-beams and rafters seem to be later than the rest (19C?). In 1999 tierods inserted in the floor to hold together the walls in both directions, metal supports added on the gables to help keep in position the purlins, sarking replaced and rotten elements partially replaced (mainly rafter ends).



Past interventions link I:\Arch\A



Past interventions link I:\Arch\A

Material Degradation:

Fungi attack ☐ Insect attack ☐ Humidity stains ☐

Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

Poor Design ☐

Poor Construction ☐

Poor Maintenance ☐

Material Degradation ☐

Past interventions ☐

Extreme actions ☐

Other ☐

link

Description of visible damage

link

Other Notes

The hypothesis is that originally the central king-post went down to the floor, and stood on the spine wall underneath. That's why the raised tie-beam is interrupted and not the post itself. But the joint at the apex doesn't go well with this idea, because the post is supported by the rafters and not viceversa (but maybe they just copied that joint from another roof or from a manual and they didn't understand its structural role...). In any case, when they cut the central post, they

Attachments I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui link

BRUNSTANE HOUSE

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)
X coordinate: 331773 Y coordinate: 672432
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 53920

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
DEMOLITION	1547		TOWERHOUSE DEMOLISHED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1565		L PLAN HOUSE BUILT	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1639		NORTH JAMB EXTENDED TO WEST AND TOWER ADDED IN NORTHEAST CORNER	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
MAITLAND	JOHN 1ST DUKE OF L	ARCHITECT, COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1672	1674	SUPPOSED TO DOUBLE IN SIZE BUT EAST RANGE SHORTER THAN ENVISAGED AND SOUTH RANGE ONLY OFFICE WING	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT	☐
YOUNG	JOHN	WRIGHT	☐
STARK	JAMES	OVERSEER	☐
WOTHERSPOON	PATRICK	MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1735	1744	S RANGE REBUILT AND NEW OFFICE COURT BUILT	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
FLETCHER	ANDREW LORD MILT	COMMISSIONERPATRON	☐
ADAM	WILLIAM	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1775	1800	SOUTH WING HEIGHTENED? NORTH WING REROOFED?	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1800	1899	MODERN CORRUGATED ASBESTOS ROOF ON SOUTH WING	HS

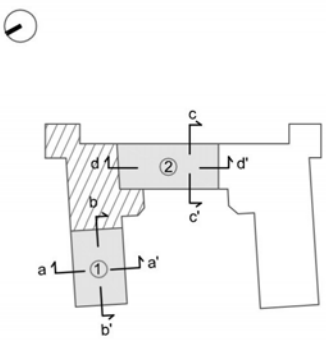
People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	79
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	

Author	Year	Unpubl.	Title	Pages
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	12
RCAHMS WEBSITE	2015	☐	HTTP://WWW.RCAHMS.GOV.UK/	
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	13

Suggestions for further research



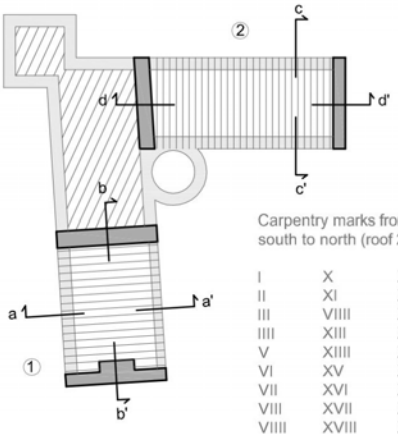
Legend (plans):

Plan 1:1000

- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500

- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Carpentry marks from east to west (roof 1):

VIII	XI
XII	XIII
V	III
I	IIΛX
X	VIIII
IΛX	ΛX
II	ΛIX
IIII	not visible

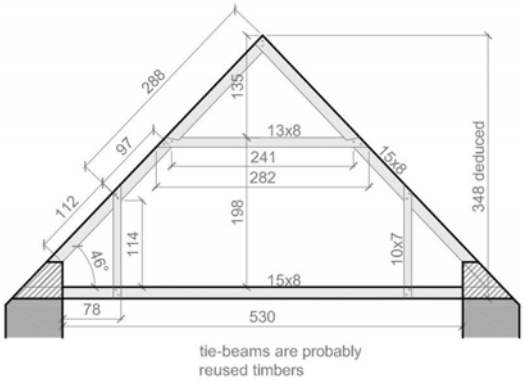
Carpentry marks from south to north (roof 2):

I	X	XIX
II	XI	XX
III	VIIII	XXI
IIII	XIII	XXII
V	XIIII	XXIII
VI	XV	XXIV
VII	XVI	XXV
VIII	XVII	XXVI
VIIII	XVIII	XXVII

Plan 1:1000 I:\Arch\ADCRU\1718cent scott

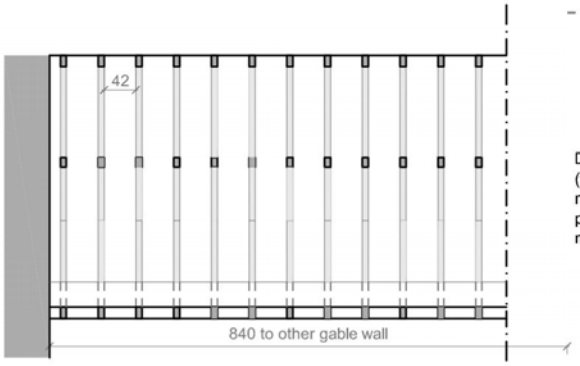
Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa': ROOF ①



tie-beams are probably reused timbers

Section bb': ROOF ①

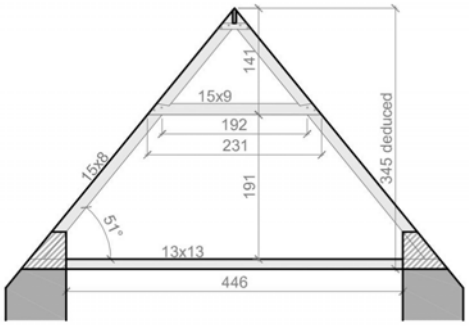


Legend (section):

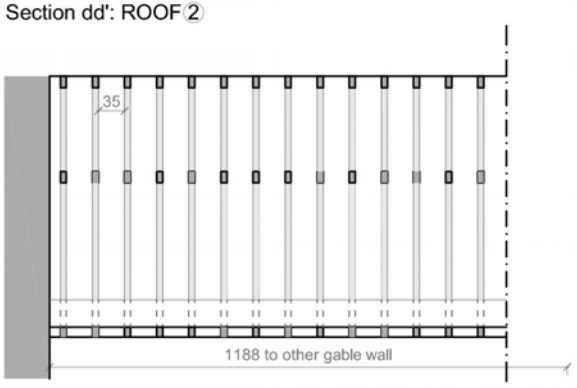
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section cc': ROOF ②



Section dd': ROOF ②



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** BRUNSTANE HOUSE | **Roof location** 2: central E range

Survey date(s) 11/08/2015 | See drawing: BRH-NW&C-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4.46 | Roof Height [m]: 3.45

Roof Pitch/es [°]: 51 | Roof Length [m]: 11.88

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.35

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Masonry infill, Tie-beam

Connection with gables

Roof Construction Period: From 1775 To 1800 Identified by: Estimated

Roof General Description: Gabled roof composed of closely spaced rafter couples connected transversally by one collar and a tie-beam and longitudinally by sarking boards only. Rafters and tie-beams are embedded in the masonry wall-heads. The tie-beams are reused timbers (the are more roughly dressed and have redundant joints), probably from the 1632 roof. Big hip rafters on the north side, connecting with the roof the North-East roof structure that is only partly visible.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular, Square with wanes

Rafter Scantling [cm] H: 15 B: 8 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description: Rafters' apex ridge beam with short horizontal strut underneath (fixed with metal nails). Between rafters and collars lapped dovetail with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Mostly in sequence numbered from 1 to 27 from south to north

Signs of reused timbers: The tie-beams look older, all hand axed and with square scantlings - they could be reused timbers from the 1632 roof

Timber Treated ☐

Other Materials

Dendrochronology



Roof structure link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: rafters' apex link I:\Arch\A



Joints: rafter and collar link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: A couple of rafters on east side replaced. Sarking recently replaced.

link

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	link
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link

INITIAL SURVEY | **Building name** BRUNSTANE HOUSE | **Roof location** 1: NW range

Survey date(s) 11/08/2015 | See drawing: BRH-NW&C-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 5.3 | Roof Height [m]: 3.48

Roof Pitch/es [°]: 46 | Roof Length [m]: 8.4

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.42

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Masonry infill, Tie-beam

Connection with gables:

Roof Construction Period: From 1775 To 1800 | Identified by: Estimated

Roof General Description:

Gabled roof composed of closely spaced rafter couples connected transversally by one collar and a tie-beam and longitudinally by sarking boards only. Each frame also has a vertical strut on each side connecting tie-beams and rafters. Rafters and tie-beams are embedded in the masonry wall-heads. Hand sawn timbers with rectangular scantlings joined with lapped joints secured by metal nails. The frames are numbered with small chiselled roman numerals, not in sequence.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 15 | B: 8 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description: All lapped with metal nails - collars are sometimes dovetail too

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description: Not in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not visible

Past interventions: Sarking recently replaced

link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	
Roof Damage				link I:\Arch\A
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link I:\Arch\A

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link I:\Arch\A

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link I:\Arch\A

COWANE'S HOSPITAL

Location: STIRLING | STIRLING
X coordinate: 279172 Y coordinate: 693674
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 46196

Original Use: Hospital
Current Use: Museum, Offices

Freestanding: ☑ N. of floors above ground level: 2 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1637	1648	AN OLDER HOUSE ON THE SITE WAS DEMOLISHED TO MAKE WAY FOR IT	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
MYLNE	JOHN JUNIOR (3)	DESIGNER, ROYAL MASTER MASON	☐
RYND	JAMES	MASTER MASON	☐
BIZATT	JAMES	MERCHANT	☐
CUNNINGHAM	ALEXANDER	WRIGHT	☐
CUNNINGHAM	ARCHIBALD	WRIGHT	☐
ROBERTSON	JAMES	MERCHANT, OVERSEER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1700	1725	MAIN BLOCK DIVIDED IN TWO HALLS NAMED "GILDHALL". INTERIORS REMODELLED	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1852		OTHER ALTERATIONS MADE IN 1852	RCAHMS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1852		INTERIORS REMODELLED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
SURVEY	2010			PAUL HARDING

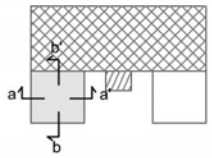
People involved:

Last Name	First Name	Role	Attributed
NARRO	DAVID	ENGINEER	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	77
GIFFORD J.	2002	☐	THE BUILDINGS OF SCOTLAND COLLECTION: STIRLING AND CENTRAL	
HARRISON J.		☑	CONSTRUCTION OF COWANE HOSPITAL	
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	15

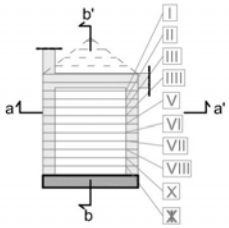
Suggestions for further research: Cowane Trust Archives



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

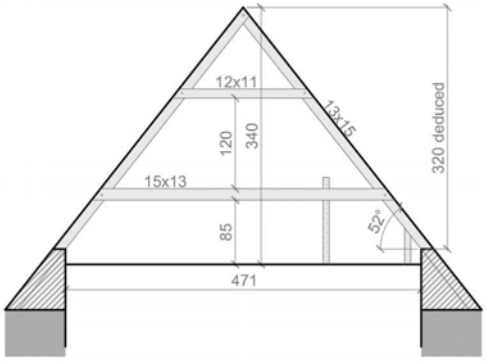
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

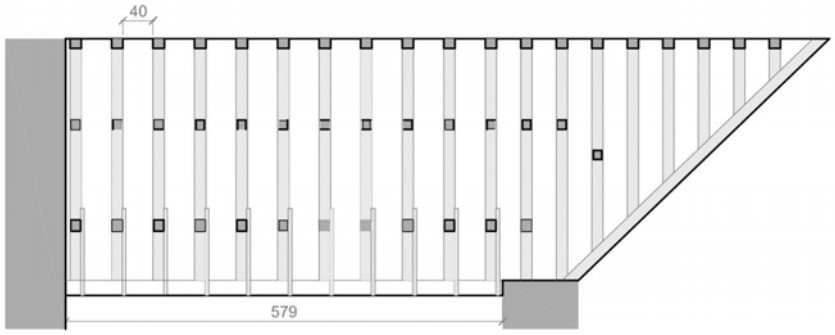
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** COWANE'S HOSPITAL | **Roof location** E wing

Survey date(s) 30/09/2014 | See drawing: CWH-E-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4.7 | Roof Height [m]: 3.4

Roof Pitch/es [°]: 52 | Roof Length [m]: 5.5

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Masonry infill

Connection with gables:

Roof Construction Period: From 1637 To 1648 Identified by: Estimated

Roof General Description:

Gabled roof intersecting the roof over the great hall (which has been replaced in 19C) on the South-East side. It is composed of closely spaced rafter couples connected transversally by two collars and longitudinally by sarking boards only. Rafters embedded in the masonry wall-heads. Timbers are all full logs roughly hadn axed. The timber pegs fixing the slates to the sarking boards partly survive. The frames are numbered with buig sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails, Timber Pegs

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 13 B: 15 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) Bark ☐

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters apex: mortice and tenon with timber pegs; between collars and rafters: chamfered half lapped with iron nails

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Numbered from south to north from I to VIII, then there is X and then an X with I in the middle.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Roof structure link I:\Arch\A



Timber elements' dressing link I:\Arch\A



Joints: rafters and collars link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance, poor ventilation, presence of water tank

Accessibility limitations: No lighting in roof space

Past interventions: Ceiling redone, maybe in mid 19C when the great hall roof was redone as well (original ceiling was probably attached under the raised tiebeam: there are some remains of laths and iron nails under the timbers). Insulation added on ceiling and water tank inserted on raised tie-beams. Some hangers added between raised tiebeams and ceiling.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☑

Insect attack on collars, not sure if active



Fungi attack | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Humidity stains | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes: In 1637 'two short trees and 39 long trees were bought in Burntisland, 20 great trees and 30 short trees at Leith'. In 1640 James Bizzat, timber merchant in Perth, was commissioned to bring timbers from Norway: '60 great trees (beams) 36 feet long and 12 inches square (11m - 30cm), 32 trees of 24 feet long (7.3m) and 380 'schorne deals' of redwood (probably pine) each 14 feet long and 12 inches wide (4.3m - 30cm)'. There were also 190 deals of 12 ells long and 60 single trees. The

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

CRAIGSTON CASTLE

Location: ABERDEENSHIRE | KING EDWARD
X coordinate: 376221 Y coordinate: 855021
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 19228

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 5 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1604	1607	DATE ON INSCRIPTION PANEL	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BEL	JOHN	DESIGNER, MASON	☑
URQUHART	JOHN	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
DESIGN	1733		FOR A PALLADIAN HOUSE, NOT EXECUTED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1745	1755	WINGS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1770		WINGS REMODELLED AND CHAPEL ADDED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

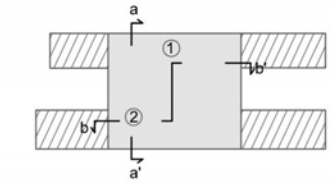
Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1834	1836	PORCH AND INTERIORS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME II. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL/ THE TWELFTH TO THE EIGHTEENTH CENTURY	483-484
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	15
WALKER D. & WOODWORTH M.	2015	☐	THE BUILDINGS OF SCOTLAND COLLECTION: ABERDEENSHIRE: NORT MORAY	

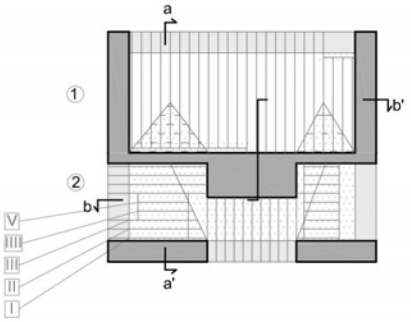
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks

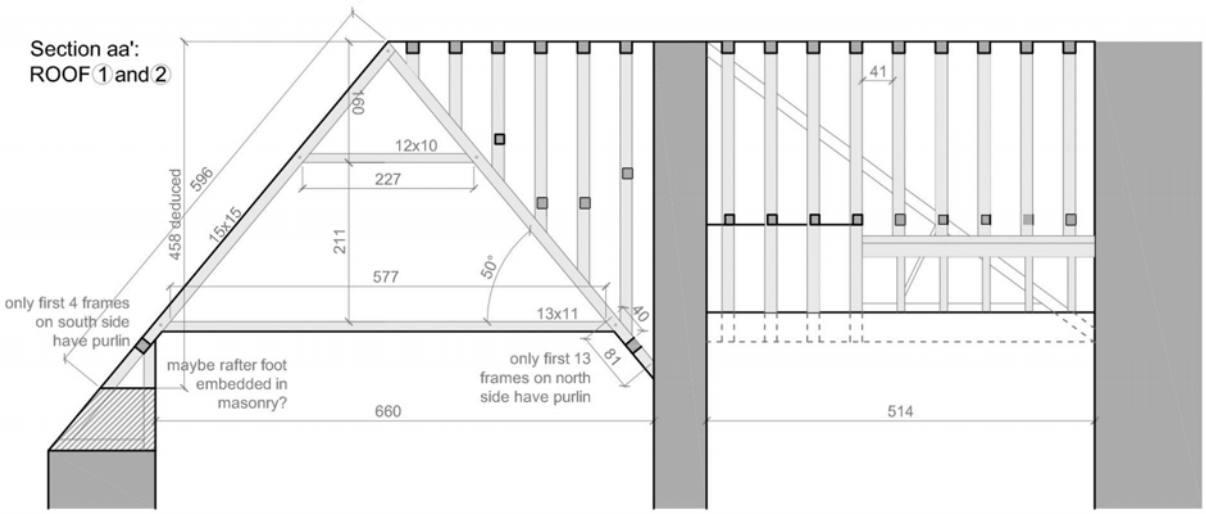


Carpentry marks from north to south (roof 1):

I	XIII
II	XIIII
III	X/
IIII	X/I
V	X/II
VI	X/III
VII	X/IIII
VIII	XX
VIIII	XXI
X	XXII
X	XXIII
XII	XXIIII

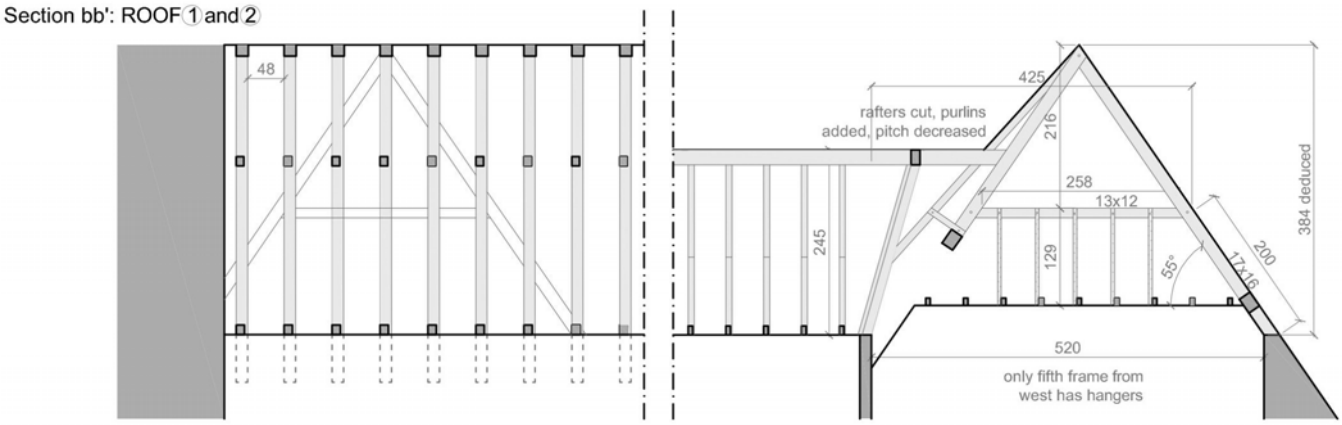
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof 1 from outside I:\Arch\A



Roof 2 from outside I:\Arch\A

INITIAL SURVEY | **Building name** CRAIGSTON CASTLE | **Roof location** 2: N range

Survey date(s) 05/08/2015 | See drawing: CRC-E&N-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.2 | Roof Height [m]: 3.84

Roof Pitch/es [°]: 55 | Roof Length [m]: 5.14

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: purlins, sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1604 To 1607 | Identified by: Estimated

Roof General Description: Two gabled roofs intersecting a mono-pitch roof in the central part. Each roof has 9 frames with one collar each. The roofs have been heavily altered during the 18C: some rafters have been cut and are now supported by purlins. Ceiling was probably higher originally.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 17 | B: 16 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, small chiseled roman numerals

Carpentry Marks Description: Big roughly cut roman numerals on collars and rafters - numbered in sequence from 1 to 5 from west to east. Purlins have small chiseled roman numerals, so they were probably added in 18C.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: rafter and purlin | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: 4 rafters on southwest side cut, purlins added to support remaining stumps, pitch decreased - probably in mid 18C when wings were added. Plaster ceiling lowered.



Past interventions | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	link
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** CRAIGSTON CASTLE | **Roof location** 1: E range

Survey date(s) 05/08/2015 | See drawing: CRC-E&N-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 6.6 | Roof Height [m]: 4.58

Roof Pitch/es [°]: 50 | Roof Length [m]: 15

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.55

Type of Secondary Structure: purlins, sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables

Roof Construction Period: From 1604 To 1607 | Identified by: Estimated

Roof General Description:

Gabled roof with two intersections to the North-East, interrupted by gable walls. It's composed of closely spaced rafter couples connected transversally by two collars and longitudinally by sarking boards only. The connection with the wall is not well visible, there might be a rafter foot. The timbers are all full logs roughly hand axed and joined with mortice and tenon joints secured by timber pegs. The frames are numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 15 | B: 15 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: In sequence

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology



Roof Structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not well visible

Past interventions: Pitch decrased in intersections. Sarking replaced in 18/19C.



Past interventions | link | I:\Arch\A



Material degradation | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Insect attack on some collars, not sure if active

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	stacking up		
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

CULROSS PALACE

Location: FIFE | CULROSS

X coordinate: 298515 Y coordinate: 685950

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC

Protection status: NATIONAL

HS Listing: SCHED Rcahms ID: 48021

Original Use: Residential

Current Use: Museum

Freestanding: ☑ N. of floors above ground level: 2 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1597	1611	PALACE (2 BUILDINGS) AND BESSIE BAR HALL - THE GROUND FLOOR OF THE WEST RANGE IS OLDER	HS

People involved:

Last Name	First Name	Role	Attributed
BRUCE	GEORGE		☐
BRUCE	GEORGE SIR OF CULR	COMMISSIONERPATRON	☐

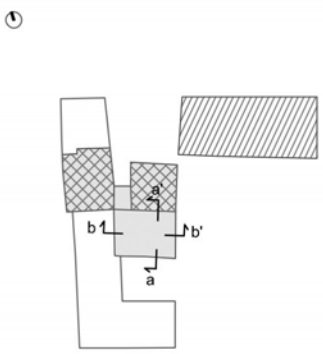
Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1700	1725	GEORGIAN PANELLING IN THE LAIRD'S ROOM. BESSIE BAR HALL WAS BUILT EITHER IN THE LATE 16TH CENTURY OR POSSIBLY AS LATE AS 1776	HS

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME II. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL/ THE TWELFTH TO THE EIGHTEENTH CENTURY	432-435
GIFFORD J.	1988	☐	THE BUILDINGS OF SCOTLAND COLLECTION: FIFE	
HANKE T.	2006	☑	THE DEVELOPMENT OF ROOF CARPENTRY IN SOUTHEAST SCOTLAND	

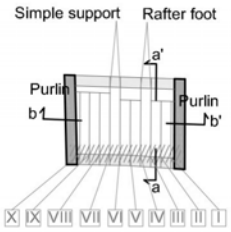
Suggestions for further research: NRS: DD27 conservation works in 1960/83, DD27 conservation works in 1992/99



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

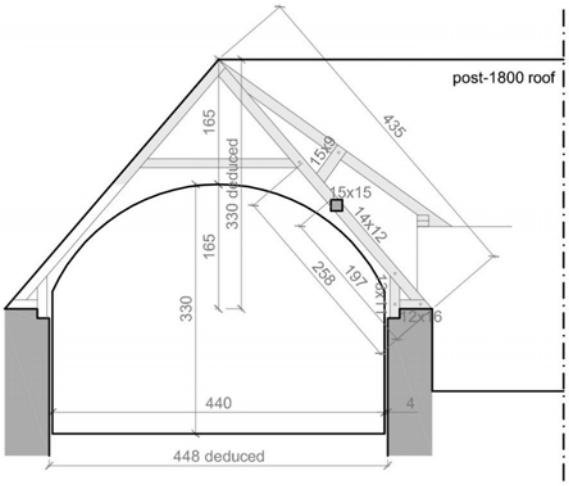
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

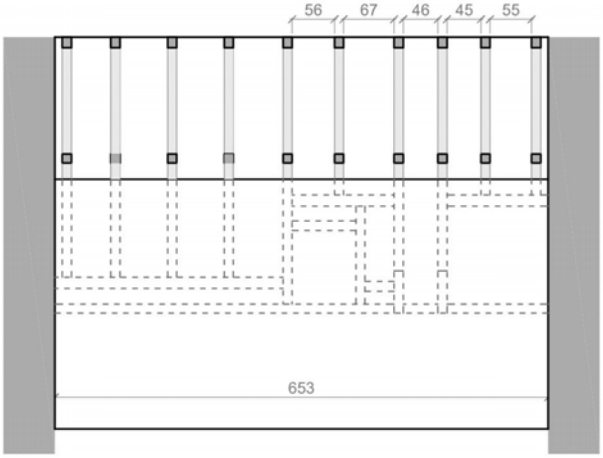
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** CULROSS PALACE | **Roof location** Central W block

Survey date(s) 17/02/2015 | See drawing: CP-W-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4.5 | Roof Height [m]: 3.3

Roof Pitch/es [°]: 49 | Roof Length [m]: 6.4

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.55

Type of Secondary Structure: purlins, sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1597 To 1611 Identified by: Estimated

Roof General Description: Gabled roof composed of closely spaced rafter couples connected transversally by one collar and longitudinally by sarking boards only. The connection with the South wall is not visible, but on the North side frames 3 and 4 have rafter feet, whilst the others rest on purlins (which could be a later alteration). Additional rafters with a reduced pitch have been added on the North side and connected to the original ones with struts. There is a secondary structure composed of curved timbers that support the timber barrel vaulted ceiling. The timbers are all full logs hand axed and joined with mortice and tenon joints secured with timber

Roofing Material: clay tiles

Roofing Material Fixing: Unknown

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 14 B: 12 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs - rafters' apex not visible

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Numbered 1 to 10 from east to west

Signs of reused timbers:

Timber Treated ☐

Other Materials: metal spikes used to secure purlin and part of a rafter that were added later to bypass one of the little lateral vaults of the ceiling

Dendrochronology:



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Connection with wall link I:\Arch\A



Joints: collar and rafter link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: original painted timber barrel vault underneath

Unfavourable conditions:

Accessibility limitations: Connection with wall on south side not visible. Rest of roof structure only visible from north side, therefore some parts were not closely inspected/measured.

Past interventions: Sarking replaced. Additional rafters with a reduced pitch added on the north side. Purlins could be a later alteration.



Past interventions: reduced pitch | link | I:\Arch\A



Past interventions: new sarking | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☐

Some insect attack, not sure if active.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage:

link

Other Notes:

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

CULZEAN CASTLE

Location: SOUTH AYRSHIRE | KYRKOSWALD
X coordinate: 223265 Y coordinate: 610285
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC
Protection status: NATIONAL
HS Listing: A Rcahms ID: 40959

Original Use: Residential
Current Use: Hotel/Inn, Meeting Hall, Museum

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1100	1199	BUILDINGS OF SCOTLAND SAYS IT WAS CALLED COIF OR COVE CASTLE	

People involved:

Intervention type:	From:	To:	Description:	Reference:
RECONSTRUCTION	1590			BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1645	1655	THE DEFENSIVE BARMKIN WALL WAS BREACHED AND 3 TERRACES WERE CONSTRUCTED AS HANGING GARDENS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1740	1770	IMPROVEMENTS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
DESIGN	1755		FOR A VILLA, NOT EXECUTED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	ROBERT	ARCHITECT	☐
KENNEDY	THOMAS 9TH EARL O	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
DESIGN	1759		FOR A BANQUETING HOUSE, NOT EXECUTED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
CHAMBERS	SIR WILLIAM	ARCHITECT	☐
KENNEDY	THOMAS 9TH EARL O	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1766	1768	A DETACHED, PLAIN, BARRACK-LIKE OFFICE HOUSE WAS BUILT ALONG THE CLIFF EDGE NORTH OF THE L-SHAPED TOWER HOUSE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1776	1782	RECASTING AND ENLARGEMENT OF THE TOWER HOUSE INTO A REGULAR RECTANGULAR PLAN, A SEPARATE KITCHEN BLOCK WAS BUILT, AND A CIRCULAR BREWHOUSE AND OFFICES IN A BUTTERFLY-LIKE PLAN	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	ROBERT	ARCHITECT	☐
KENNEDY	DAVID 10TH EARL OF	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1784	1792	SECOND PHASE OF WORKS INTENDED TO REMEDY TO THE LACK OF SEA VIEW: ALL THE PRE-1776 WORKS WERE SWEPT AWAY AND THE NORTH FRONT OF THE CASTLE TAKEN DOWN; IN ITS PLACE A 3-STOREY ADDITION; INTERIORS WERE ALTERED; MUCH WAS LEFT UNFINISHED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	ROBERT	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1877		WEST WING AND SOME INTERIOR REMODELLING	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
WARDROP & REID		ARCHITECT	☐

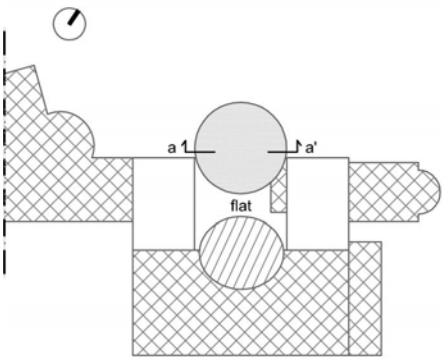
Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1945		BY NTS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CLOSE R.	2012	☐	THE BUILDINGS OF SCOTLAND COLLECTION: AYRSHIRE AND ARRAN	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	113
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	205

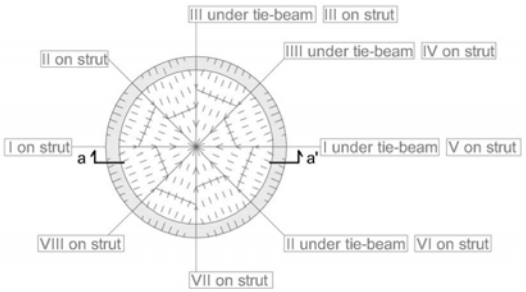
Suggestions for further research: Ayrshire Archives: building drawings by Robert Adam of Culzean Castle, 1785, 1787 (GB244/ATD34)
NRS: 1947 drawings (RHP6692) and GD25/



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

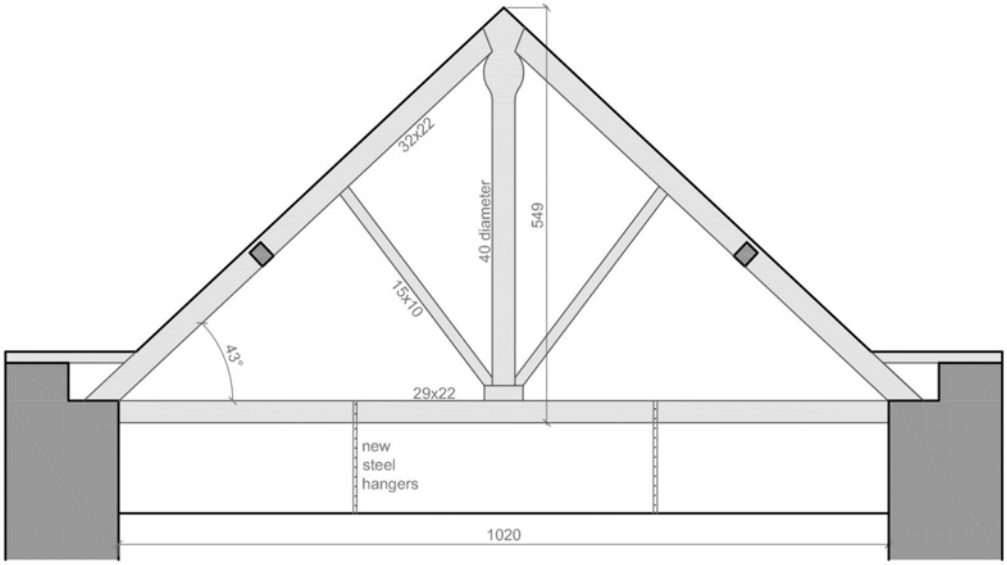
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** CULZEAN CASTLE | **Roof location** 1: Drum tower

Survey date(s) 14/08/2014 | See drawing: CUC-dt-1

Roof Geometry: Conical

Roof Max Span [m]: 10.2 | Roof Height [m]: 5.49

Roof Pitch/es [°]: 43 | Roof Length [m]: 10.2

Type of Primary Structure: 3D framing

Truss ☑ KING-POST

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm]: | thickness [cm]:

Connection with lateral walls: None

Connection with gables: no gables

Roof Construction Period: From 1791 To | Identified by: Estimated

Roof General Description: The roof was built after 1791 (there is a drawing of that date showing the drum tower unroofed). 4 radial trusses with a central post in tension supported by the rafters and holding up the tie-beams, and slanted struts. 1 tie-beam is continuous, the others are interrupted in the middle. 1 butt-purlin between each couple of pricipal rafters. The flat ceiling underneath hangs from the tie-beams. Hand sawn timbers of big scantlings joined with mortice and tenon joints secured by metal straps.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular, Round

Rafter Scantling [cm] H: 32 B: 22 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: bulb shaped joggle, joggle, mortice and tenon

Fasteners Types: Metal strap

Joints description: All mortice and tenon. Central post made of 2 half-rounded timber pieces kept together by 2 metal straps. A metal strap at the bottom end of the central post ties all the tie-beams together and with the post. The upper end of the post has a bulb shaped joggle.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description: Mostly in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials: Metal straps

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: post | link I:\Arch\A



Joint: under post and tie-beams | link I:\Arch\A



Joints and carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features: Original plaster ceiling underneath

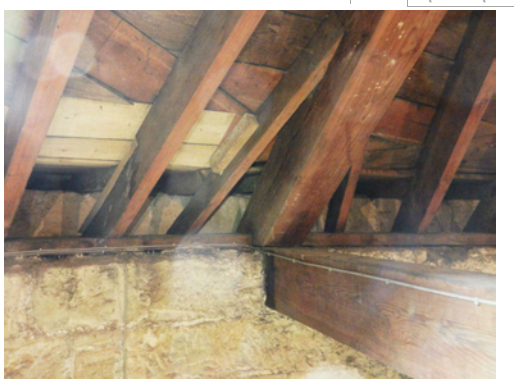
Unfavourable conditions:

Accessibility limitations:

Past interventions: Some sarking replaced. Some new steel hangers connecting the ceiling to the tie-beams.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

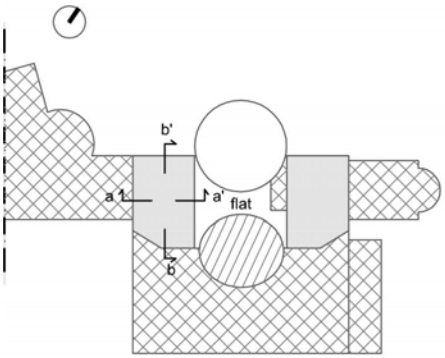
link

Description of visible damage

link

Other Notes

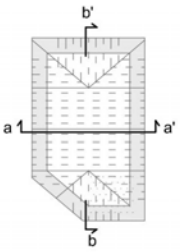
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Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

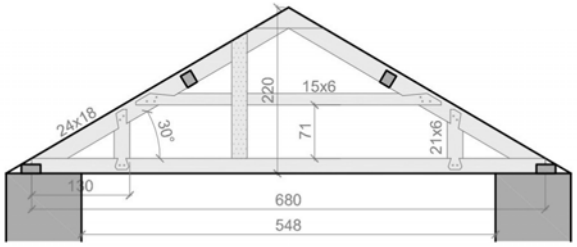
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

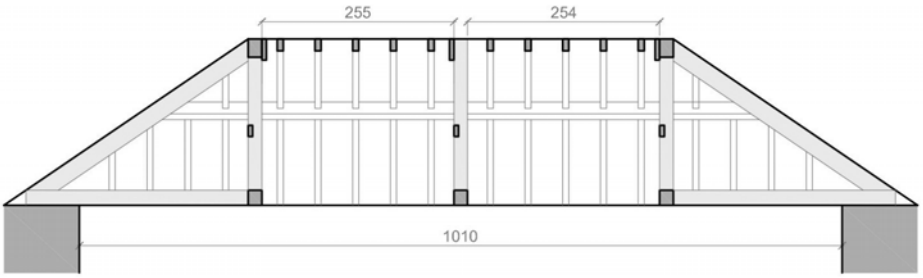
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** CULZEAN CASTLE | **Roof location** 2&3: SE & SW of drum tower

Survey date(s) 14/08/2014 | See drawing: CUC-SE&SW-1

Roof Geometry: hipped

Roof Max Span [m]: 5.48 | Roof Height [m]: 2.2

Roof Pitch/es [°]: 30 | Roof Length [m]: 10.1

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 2.5

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tie-beam, Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1784 To 1792 Identified by: Estimated

Roof General Description:

Roof probably built during the second phase of works of R. Adam (1784-1792), when the Drum tower and these two lateral rooms were added. Hipped roof supported by 4 frames with one collar each, tie-beam and vertical struts on the sides. Frames have onebutt- purlin on each side. The timbers are hand sawn and joined with notched dovetail lapped joints. Only a few small chiselled roman numerals are visible.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 24 B: 18 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal nail

Joints description:

Dovetail notched lapped between collar and rafter and between ashlar post and rafter, with metal nails. Rafter's apex not visible. It has a rounded joggle.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: rafters' apex and hip | link I:\Arch\A



Joints: rafter and collar/strut | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourablec onditions

Accessibility limitations

Past interventions: Some sarking replaced, especially in the lower part. South corner completely rebuilt, all timbers replaced.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☐

Humidity stains on common rafters in the hip area especially



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Humidity stains | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

DUFF HOUSE

Location: ABERDEENSHIRE | BANFF
X coordinate: 369062 Y coordinate: 863316
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC
Protection status: NATIONAL
HS Listing: SCHED Rcahms ID: 18493

Original Use: Residential
Current Use: Museum

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1735	1740	INCOMPLETE	HS

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐
DUFF	WILLIAM	COMMISSIONERPATRON	☐
JAMIESON	GEORGE	MASON	☐
BURN	JOHN	CARVER	☐
JOHNSTON	JOHN	WRIGHT	☐
BURT	JOHN	OVERSEER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1754		FITTING OUT OF INTERIORS AT FIRST FLOOR	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
DOTT	THOMAS	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1790		INTERIORS COMPLETED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
LYON	JAMES	PLASTERER	☐
ROBERTSON	JAMES	PLASTERER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1870		WINGS, DAMAGED IN 1941 BY A BOMB AND LATER DEMOLISHED	ADAM/SIMPSON 2011

People involved:

Last Name	First Name	Role	Attributed
BRYCE	DAVID		☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1956	1995		BUILDINGS OF SCOTLAND COLLECTION

People involved:

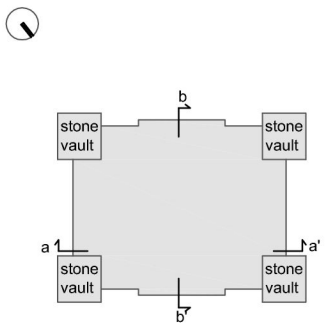
LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CRONE A.	2008	☑	THE NATIVE OAK AND PINE PROJECT: DENDROCHRONOLOGICAL ANA DUFF HOUSE, BANFF	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	104
WALKER D. & WOODWORTH M.	2015	☐	THE BUILDINGS OF SCOTLAND COLLECTION: ABERDEENSHIRE: NORT MORAY	

Author	Year	Unpubl.	Title	Pages
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 146-148

Author	Year	Unpubl.	Title	Pages
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	146-148

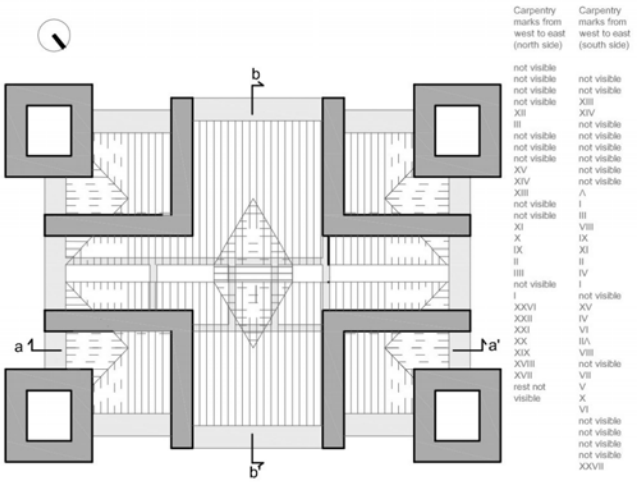
Suggestions for further research	University of Aberdeen Special Libraries and Archives: Duff family papers (GB231/MS 997 - GB231/MS 2727 - GB231/MS 3175) NRS: plan of ground floor 1740 (RHP31470) and correspondance



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

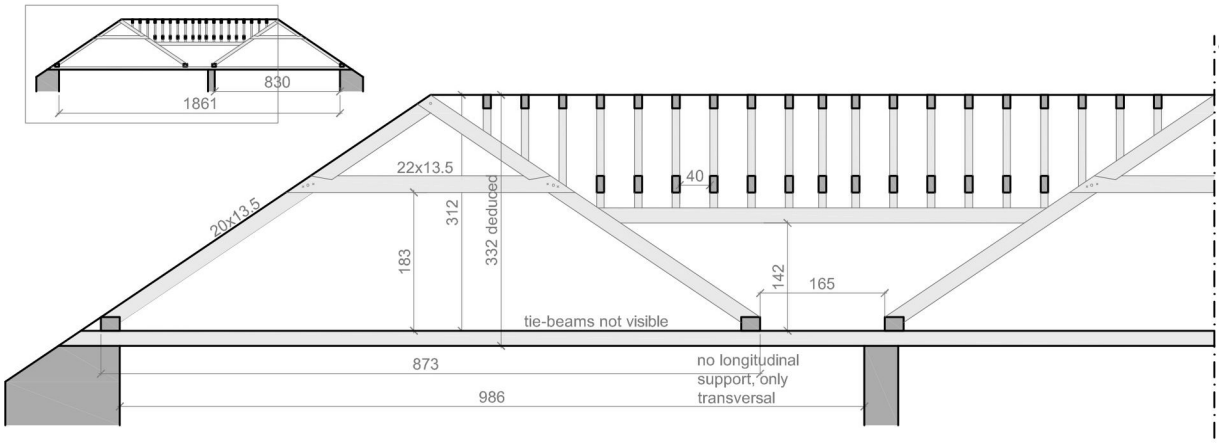
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

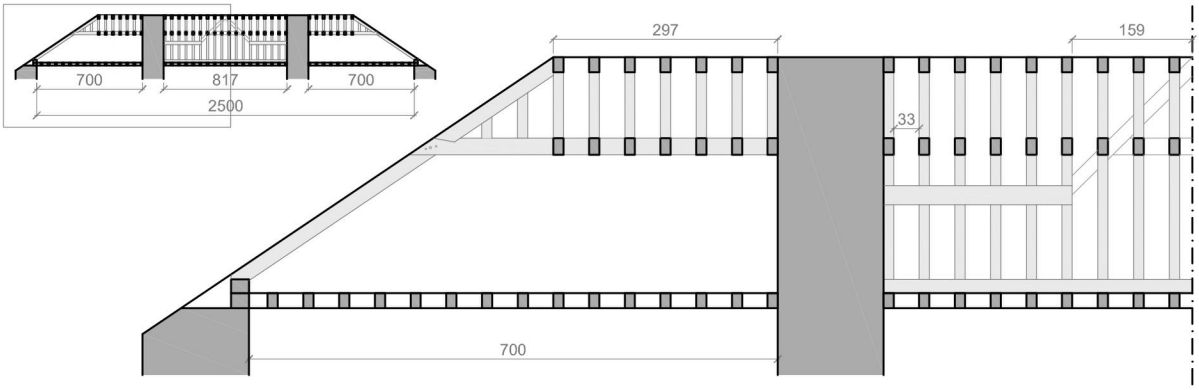
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Maquette of house I:\Arch\A

INITIAL SURVEY | **Building name** DUFF HOUSE | **Roof location** Main block

Survey date(s) 02/09/2014 | See drawing: DH-MB-1

Roof Geometry: Hipped, M shape

Roof Max Span [m]: 9.86 | Roof Height [m]: 3.32

Roof Pitch/es [°]: 34 | Roof Length [m]: 25

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.35

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tie-beam, Wall-plate

Connection with gables:

Roof Construction Period: From 1737 To | Identified by: Dendrochronol

Roof General Description:

The house is a double pile with 4 small turrets in each corner. The turrets are covered by stone vaults. The rest of the roof is a hipped M roof with an intersecting roof in the middle. Supported by corner walls and frames with a tie-beam and a collar. South-East corner room is still plastered (as was everything once, probably). Connection with the wall is not well visible.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 20 | B: 13.5 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon, scarf

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters apex: mortice and tenon with timber pegs; between rafters and collars: dovetail lapped with metal nails (some have a timber peg as well); between rafters and tie-beam not visible; 2 different scarf joints in wall plates

Wood Species: scandinavian pine (Crone 2008) | Way of identification: dendrochronology

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description: Not in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:

Dendrochronology carried out by Crone on the roof structure and dated to 1565-1737 (scots pine from braemar or norway)



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Dressing and carpentry marks | link I:\Arch\A



Joints: scarf joint in wall-plate | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation, presence of water tank

Accessibility limitations

Past interventions: Re-sarked and re-leaded in 1958. Works done in 1990s (not sure what). Few timbers partly replaced.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link | I:\Arch\A

Description of visible damage

link

Other Notes: Some frames have bigger scantlings: rafter: 27x20cm; collar 22x18cm

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

EDINBURGH PANMURE HOUSE

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)

X coordinate: 326511 Y coordinate: 673873

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 132518

Original Use: Residential

Current Use: Museum, School

Freestanding: ☑ N. of floors above ground level: 2 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1690		T PLAN HOUSE	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1840	1849	HOUSE TRUNCATED TO THE NORTH, REDUCING IT TO AN L PLAN	

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1956	1957	COMPLETELY GUTTED, ONLY OUTSIDE MASONRY AND ROOF STRUCTURES LEFT, EXCEPT FOR TIE-BEAMS THAT WERE REMOVED TO MAKE NEW CEILINGS.	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
SURVEY	2011		ARCHAEOLOGICAL	HS STEVEN ROBB

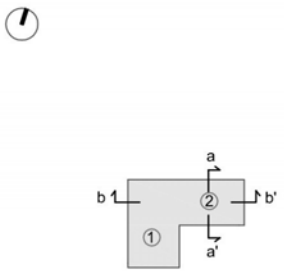
People involved:

Last Name	First Name	Role	Attributed
ADDYMAN ARCHAEOLOGY		ARCHAEOLOGIST	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
ADDYMAN ARCHAEOLOGY	2011	☑	PANMURE HOUSE - PANMURE CLOSE, CANONGATE, EDINBURGH - A AND HISTORICAL APPRAISAL OF THE HOUSE AND ITS URBAN CONTE EDINBURGH BUSINESS SCHOOL	
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	

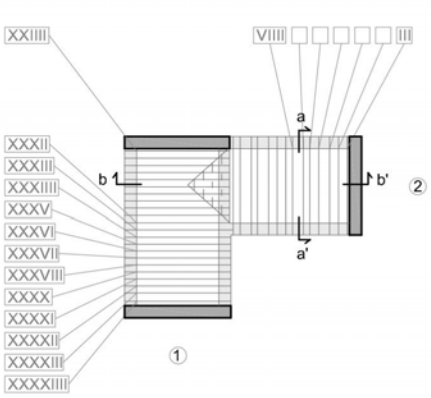
Suggestions for further research:



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

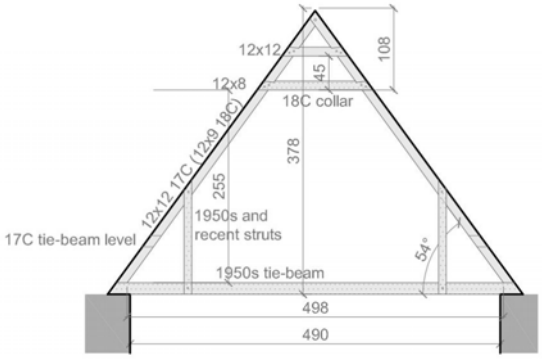
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

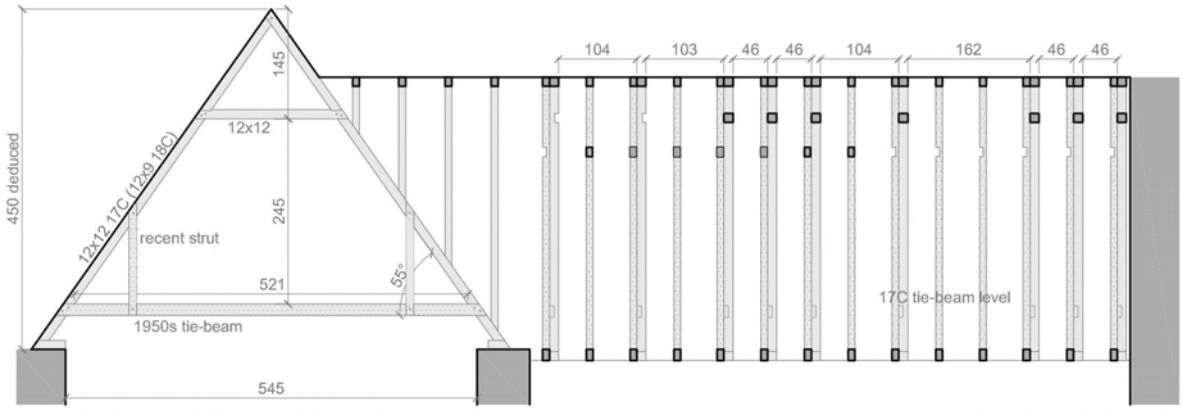
Section aa': ROOF 2



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb': ROOF 1 and 2



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** EDINBURGH PANMURE HOUSE | **Roof location** 1: S range

Survey date(s) 16/09/2014 | See drawing: EPH-ALL-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.45 | Roof Height [m]: 4.5

Roof Pitch/es [°]: 55 | Roof Length [m]: 10.4

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.48

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1690 To | Identified by: Estimated

Roof General Description:

Gabled roof intersecting roof 2 on West side. Original frames placed side by side with later frames (probably 18C) and very recent ones. Original frames are fragmentary: they had a tie-beam, which has been removed, one collar and rafter feet, which have been cut and partly removed. Some original collars have been removed. 18C frames have one collar. Sarking is probably from 18C too.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 12 B: 12 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: half lapped with timber pegs; between rafters and collars: dovetail lapped with metal nails; between rafters and tie-beams: lapped; between rafter and sole piece: mortice and tenon with timber peg

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

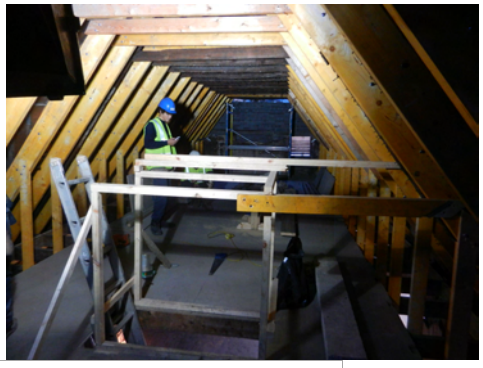
Visible numbers are in sequence. Nembered from 24 to 34 from north to south. Frames from 1 to 23 were in the northern jamb that has been removed in 19C.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



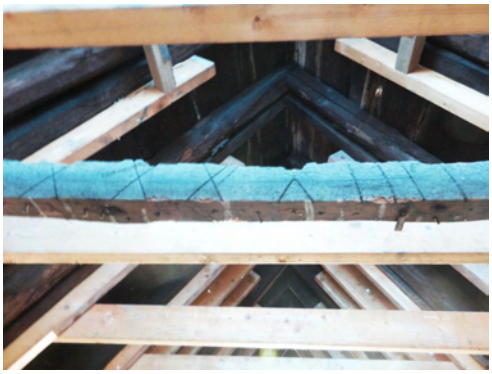
Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Frames doubled in 18C, and sarking replaced. Works in 1950s include: removed tie-beams and placed new ones at a lower level (attached to the 18C structure), replaced some masonry with bricks. Ongoing works to transform the house into an educational centre: frames doubled again, 1950s tie-beams raised to original 17C height, reslating.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Insect attack on original timbers, not sure if active



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

INITIAL SURVEY | **Building name** EDINBURGH PANMURE HOUSE | **Roof location** 2: E range

Survey date(s) 16/09/2014 | See drawing: EPH-ALL-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4.9 | Roof Height [m]: 3.78

Roof Pitch/es [°]: 54 | Roof Length [m]: 7.95

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.46

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1690 To | Identified by: Estimated

Roof General Description: Gabled roof intersecting roof 1 on East side. Original frames placed side by side with later frames (probably 18C) and very recent ones. Original frames are fragmentary: they had a tie-beam, which has been removed, one collar and rafter feet, which have been removed too. Some original collars have been removed. 18C frames have lower collars and vertical struts. Sarking is probably from 18C too.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 12 B: 12 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Rafters' apex: half lapped with timber pegs; between rafters and collars: dovetail lapped with metal nails; between rafters and tie-beams: lapped; between rafter and sole piece: mortice and tenon with timber peg

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Only few visible

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Redundant joints | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations



Past interventions link I:\Arch\A

Past interventions: Frames doubled in 18C, and sarking replaced. Works in 1950s include: removed tie-beams and placed new ones at a lower level (attached to the 18C structure), replaced some masonry with bricks. Ongoing works to transform the house into an educational centre: frames doubled again, 1950s tie-beams raised to original 17C height, reslating.

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

link I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link I:\Arch\A

Description of visible damage

link

Other Notes

Attachments I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui link

FOUNTAINHALL HOUSE

Location: EAST LOTHIAN | PENCAITLAND
X coordinate: 342657 Y coordinate: 667715
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 54713

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

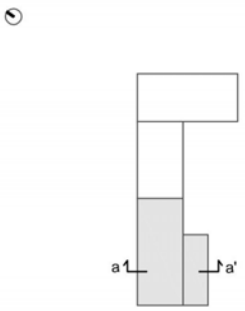
INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1575	1600	WEST PART	CANMORE
People involved:				
ADDITION	1600	1625	EXTENDED TO EAST	CANMORE
People involved:				
ADDITION	1638		EAST JAMB	BUILDINGS OF SCOTLAND COLLECTION
People involved:				
ALTERATION	1920		ALTERATIONS TO ROOF SPACE TO MAKE LIBRARY - NEVER COMPLETED	OWNER
People involved:				

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME II. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL/ THE TWELFTH TO THE EIGHTEENTH CENTURY	550-554
HANKE T.	2006	☑	THE DEVELOPMENT OF ROOF CARPENTRY IN SOUTHEAST SCOTLAND	
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	

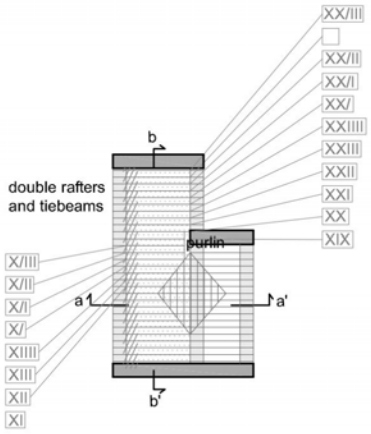
Suggestions for further research: NRS: plan of 1782 (RHP22306); papers relating to alterations in 1782/6 (GD1/1252/1/22); repairs in 1837 (GD41/523)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

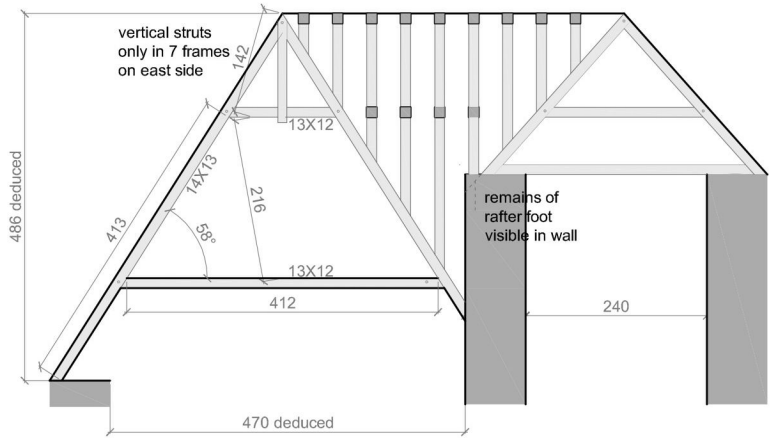
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

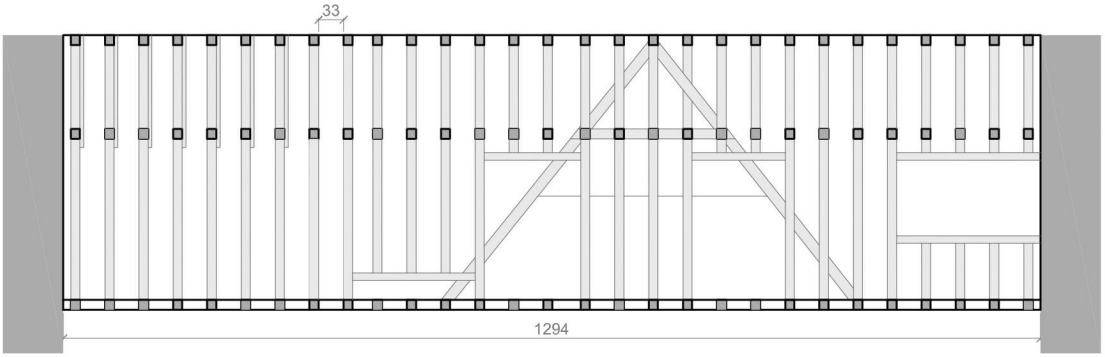
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** FOUNTAINHALL HOUSE | **Roof location** 1: SW range

Survey date(s) 08/07/2015 | See drawing: FH-SW-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4.7 | Roof Height [m]: 4.8

Roof Pitch/es [°]: 58 | Roof Length [m]: 12.9

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.33

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 3.5

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1600 To 1625 | Identified by: Estimated

Roof General Description:

2 two-pitch gabled roofs, joined in the central part by an intersecting roof (which is of later date). Both roofs composed of closely spaced rafter couples connected transversally by two collars and longitudinally by sarking boards only. The connection with the wall of the North side roof is not visible, but the South side roof has remains of rafter feet. The timbers are all full logs hand axed and joined with mortice and tenon joints secured by timber pegs. They are all covered with a black paint (tar probably). They are numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails, Timber Pegs

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 14 | B: 13 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Mostly in sequence.

Signs of reused timbers:

Timber Treated ☑ bitumen

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Timber elements' dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: The connection with the wall on the west side is not visible

Past interventions: Double rafters have been added, and tie-beams as well. Some rafters have been cut to leave space for new dormers. Some sarking has been replaced.



Past interventions | link | I:\Arch\A



Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains on sarking.

Stacking up | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	stacking up	Unknown	Primary
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient overall arrangement
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

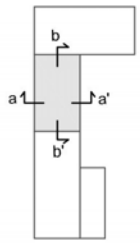
link

Description of visible damage: The frames seem to be leaning to west.

link

Other Notes

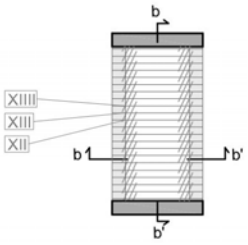
Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

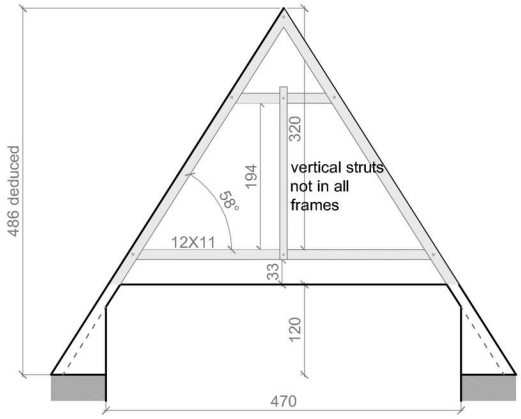
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

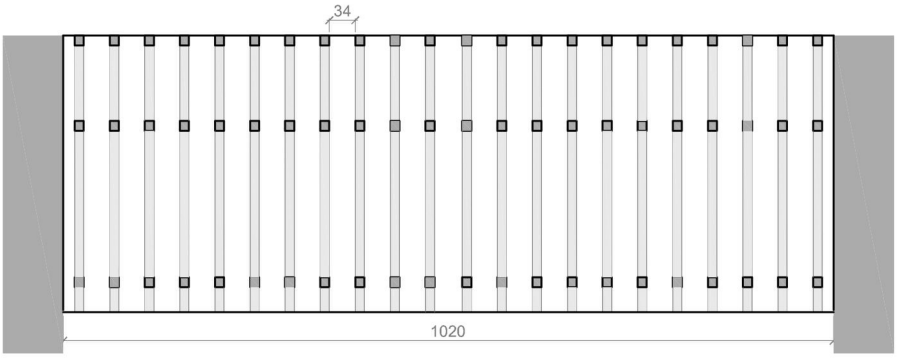
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** FOUNTAINHALL HOUSE | **Roof location** 2: central block

Survey date(s) 08/07/2015 | See drawing: FH-CB-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 4.7 | Roof Height [m]: 4.8

Roof Pitch/es [°]: 58 | Roof Length [m]: 10.2

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ King-strut

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1600 To 1625 | Identified by: Estimated

Roof General Description:

Two-pitch gabled roof, composed of closely spaced rafter couples connected transversally by two collars and longitudinally by sarking boards only. The connection with the wall is not visible. The timbers are all full logs hand axed and joined with mortice and tenon joints secured by timber pegs. They are all covered with a black paint (tar probably). They are numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: | B: | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description:

All mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☑ bitumen

Other Materials:

Dendrochronology:



Roof Structure | link I:\Arch\A



Roof Structure | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joints: collar and rafter | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Roof visible from hatch only, therefore most of it was not closely inspected/measured

Past interventions



Material degradation | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

insect attack on collar, not sure if active

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes

Attachments link

GARDYNE'S LAND

Location: DUNDEE, CITY OF | DUNDEE (DUNDEE, CITY OF)
X coordinate: 340334 Y coordinate: 730292
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 186050

Original Use: Residential
Current Use: Hotel/Inn

Freestanding ☐ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1560		TOWER HOUSE TO NORTH EAST	HS
People involved:				
ADDITION	1630	1680	MERCHANT HOUSE ON CENTRE SOUTH	SIMPSON AND BROWN
People involved:				
ALTERATION	1700	1725	FRONTAGE ON HIGH STREET	HS
People involved:				
ADDITION	1790		MERCHANT HOUSE ON SOUTHWEST	SIMPSON AND BROWN
People involved:				
ALTERATION	1800	1899		SIMPSON AND BROWN
People involved:				
ADDITION	1820		BUILDING TO REAR (NORTH)	SIMPSON AND BROWN
People involved:				
ADDITION	1870		BUILDING TO EAST	SIMPSON AND BROWN
People involved:				
CONSERVRESTOR	2004	2007	BY TAYSIDE BUILDINGS PRESERVATION TRUST	CANMORE

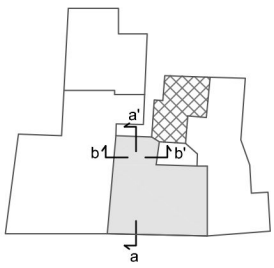
People involved:

Last Name	First Name	Role	Attributed
SIMPSON & BROWN		ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CRONE A.	2001	☑	GARDYNE'S LAND, DUNDEE; DENDROCHRONOLOGICAL ANALYSIS OF STRUCTURAL TIMBERS FOR TAYSIDE BUILDING PRESERVATION TRUS	
GIFFORD J.	2012	☐	THE BUILDINGS OF SCOTLAND COLLECTION: DUNDEE AND ANGUS	
NEWLAND K.	2010	☑	THE ACQUISITION AND USE OF NORWEGIAN TIMBER IN SEVENTEEN CENTURY SCOTLAND, WITH REFERENCE TO THE PRINCIPAL BUILDING JAMES BAINE, HIS MAJESTY'S MASTER WRIGHT	
TAYSIDE BUILDING PRESERVATION TRUST	2004	☑	GARDYNE'S LAND CONSERVATION PLAN	

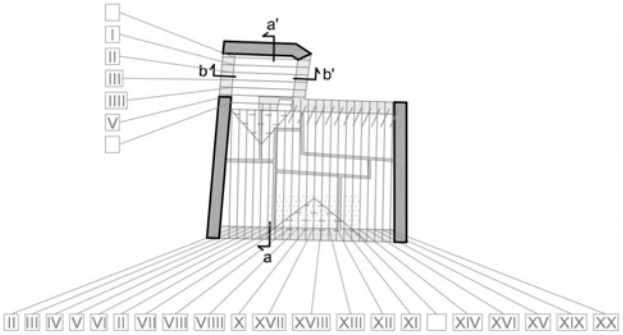
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

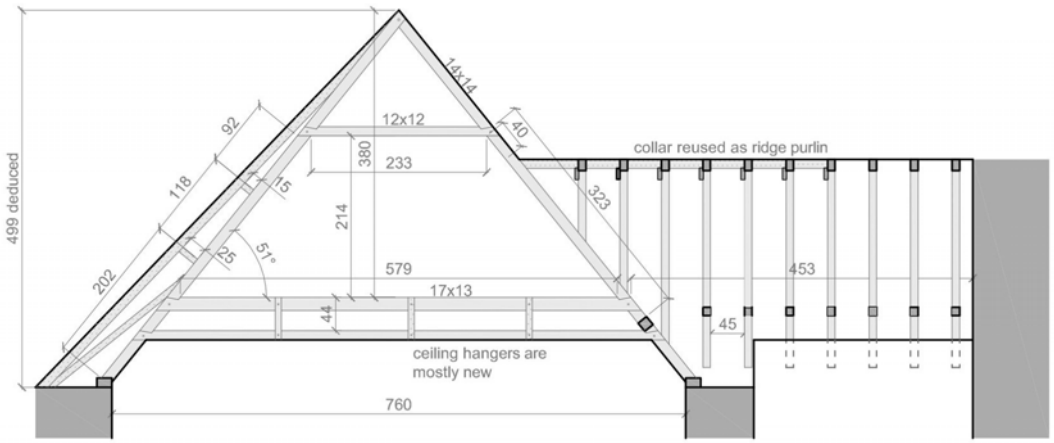
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

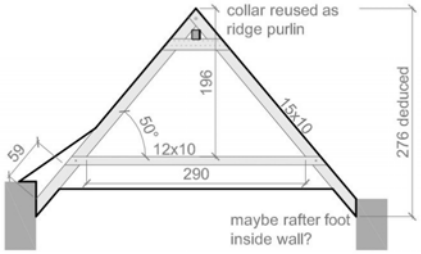
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** GARDYNE'S LAND | **Roof location** 1: centre S, roof spanning NS

Survey date(s) 28/07/2015 | See drawing: GL-CS-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 7.6 | Roof Height [m]: 5

Roof Pitch/es [°]: 51 | Roof Length [m]: 10.9

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 3

Connection with lateral walls: None

Connection with gables:

Roof Construction Period: From 1675 To 1690 | Identified by: Dendrochronol

Roof General Description:

Two gabled roofs intersecting perpendicularly. Composed of closely spaced rafter couples connected trasversally by two collars and longitudinally by sarking boards only. The connection with the wall is only partly visible: there seems to be a wall-plate. In the intersection with the other roof there is a purlin suppoorting the rafter lower ends. The timbers are all full logs hand axed and numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 14 | B: 14 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafter's apex: mortice and tenon with timber pegs not flush.
Between rafters and collars: lapped chamfered with metal nails.

Wood Species: pinus sylvestris and one oak element (Crone 2001) | Way of identification: dendrochronology

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description:

Roman numerals partly in sequence.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:

Carried out by Anne Crone in 2001. Only 5 samples analysed: one is oak, the others pine. No dates fpr pine - only estimation for oak sample



Roof Structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

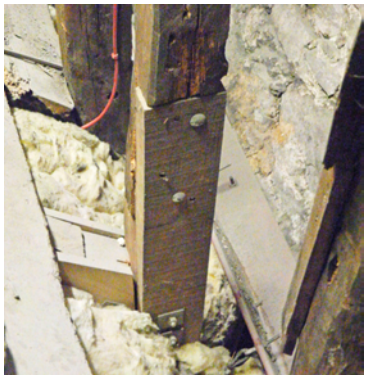
Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall only partly visible

Past interventions: Pitch lowered on south side and sarking replaced, probably in early 18C when the south frontage was remade and small pediment added. Steel cables and beam inserted in 2004/7 to counteract lower collars deflection in correspondence of 18C south gable. Double collars added, and rafters partly replaced (same period).



Past interventions | link | I:\Arch\A

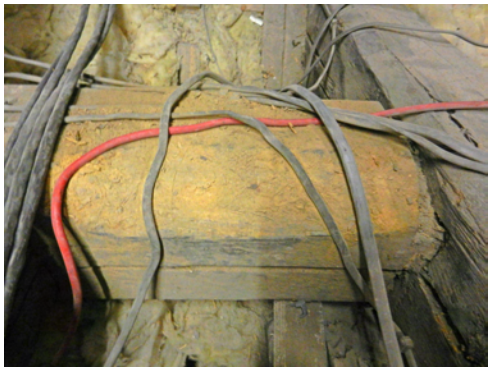
Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Some timbers, not sure if active



Deflection & past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage	Permanent Deformation	Intervened on	Primary
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☑ increase of dead loads
- Extreme actions ☐
- Other ☐

Description of visible damage: Lower collars of frames in correspondance with the 18C south gable are deflected. Steel cables and beam inserted in 2004/7 to counteract deflection - not sure if effective.

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** GARDYNE'S LAND | **Roof location** 2: centre S, roof spanning EW

Survey date(s) 28/07/2015 | See drawing: GL-CS-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4 | Roof Height [m]: 2.76

Roof Pitch/es [°]: 50 | Roof Length [m]: 3.7

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 3

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1675 To 1690 Identified by: Dendrochronol

Roof General Description: Two gabled roofs intersecting perpendicularly. Composed of closely spaced rafter couples connected trasversally by two collars and longitudinally by sarking boards only. The connection with the wall is embedded in the wall: there could be a rafter foot. The timbers are all full logs hand axed and numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 15 B: 10 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☑

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Rafter's apex: mortice and tenon with timber pegs not flush. Between rafters and collars: lapped chamfered with metal nails.

Wood Species: pinus sylvestris (Crone 2001) | Way of identification: dendrochronology

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: In sequence.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology: Carried out by Anne Crone in 2001. Only 5 samples analysed: one is oak, the others pine. No dates fpr pine - only estimation for oak sample



Roof Structure link I:\Arch\A



Connection with wall link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: rafters' apex link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: presence of water tank

Accessibility limitations: Connection with wall only partly visible

Past interventions: Sarking replaced. Ridge beam added. Prosthesis at rafters ends.



Past interventions | link | I:\Arch\A



Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Some timbers, not sure if active

Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

GEILSTON HOUSE

Location: ARGYLL AND BUTE | CARDROSS (ARGYLL AND BUTE)
X coordinate: 234017 Y coordinate: 678278
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC
Protection status: NATIONAL
HS Listing: B Rcahms ID: 141629

Original Use: Residential
Current Use: Not in use

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1666		PROBABLY INCORPORATING EARLIER FABRIC (SQUARE TOWERHOUSE?)	HS
People involved:				
ADDITION, ALTERATION	1729		NORTHEAST KITCHEN WING AND OVERALL REMODELLING	
People involved:				
ADDITION	1787		STABLES BLOCK (MAYBE)	
People involved:				
ADDITION, ALTERATION	1800	1850		HS
People involved:				
ADDITION	1900	1999	NORTHWEST WING, PORCH, GEENHOUSE	
People involved:				
SURVEY	1998		HISTORICAL AND ARCHAEOLOGICAL	NTS DEREK ALEXANDER

People involved:

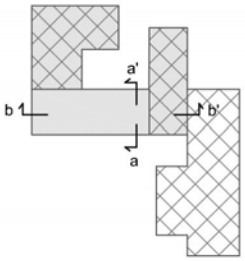
Last Name	First Name	Role	Attributed
ADDYMAN ARCHAEOLOGY		ARCHEOLOGIST	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2006		A STEEL FRAME WAS INSERTED TO HELP SUPPORT THE ROOF AS THE TIMBERS WERE AT QUITE AN ANGLE	NTS DEREK ALEXANDER
People involved:				

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
ARNEIL F.	2000	☐	THE BUILDINGS OF SCOTLAND COLLECTION: ARGYLL AND BUTE	
GLASGOW UNIVERSITY ARCHAEOLOGICAL RESEARCH DIVISION	1998	☑	GEILSTON HOUSE AND GARDEN, CARDROSS - AN HISTORIC BUILDINC LANDSCAPE SURVEY CARRIED OUT ON BEHALF ON THE NATIONAL TF SCOTLAND	

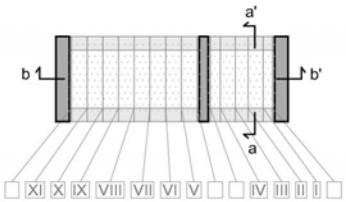
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

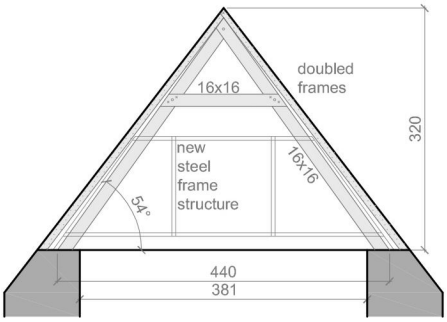
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

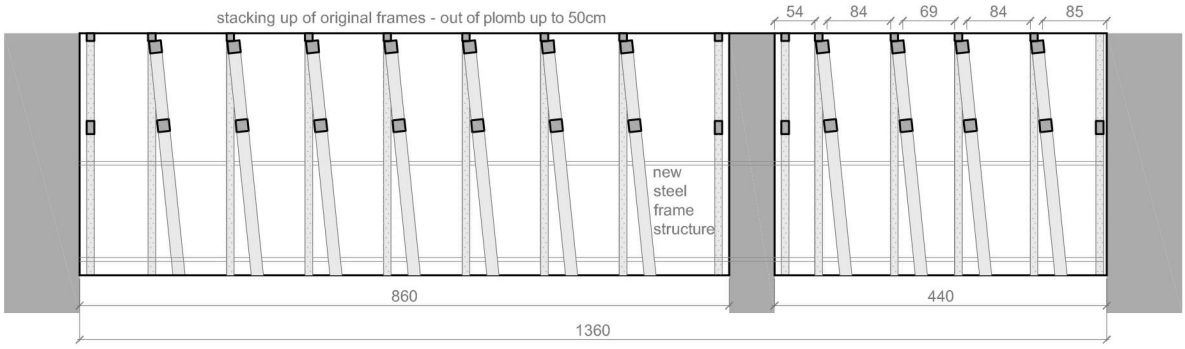
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** GEILSTON HOUSE | **Roof location** SW block

Survey date(s) 20/08/2014 | See drawing: GH-SW-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 3.95 | Roof Height [m]: 3.2

Roof Pitch/es [°]: 54 | Roof Length [m]: 13.6

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.9

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: None

Connection with gables:

Roof Construction Period: From 1666 To | Identified by: Estimated

Roof General Description:

Gabled roof supported by an intermidiate transversal wall and 14 frames with one collar each. The rafters simply sit on the walls. The frames have been doubled, and some new have been added, and there is a new steel frame structure. Some of the timbers of the original structure look older than the suggested construction date: 1666. They are probably reused timbers from the previous 16C construction. The building is not in use, which hinders its maintenance.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 16 B: 16 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☑

Joint Types: lapped

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: lapped with timber pegs not flush. Between rafters and collars: lapped with timber pegs not flush and metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: arabic numerals, big roughly cut roman numerals, lettering, runic marks

Carpentry Marks Description:

In sequence numbered I to XII from east to west

Signs of reused timbers:

Some redundant joints - also dressing of the timbers (very rough) suggests a date older than 1666

Timber Treated ☐

Other Materials:

Steel tubes frame

Dendrochronology:



Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Redundant joints | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance

Accessibility limitations

Past interventions: Sarking partly replaced. Rafters and collars doubled, with lower pitch. New frames added close to walls. Steel frame structure added between floor and collars, standing on wall-head - supposed to be temporary, has been there for 10 years.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	stacking up	Active	Primary
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient overall arrangement
- Poor Construction ☐
- Poor Maintenance ☑
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: stacking up | link | I:\Arch\A

Description of visible damage: Original frames are stacking up in west direction - out of plomb up to 50cm

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

GEORGE FORT

Location	HIGHLAND	ARDERSIER	
X coordinate	276076	Y coordinate	856678
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PUBLIC		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	14317
Original Use	Military		
Current Use	Military, Museum		

Freestanding ☑ N. of floors above ground level

Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
DESIGN	1746		NOT EXECUTED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
CAMPBELL	DUGAL	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1747	1769	FIRST DESIGN FOR THE SITE WHERE THE CROMWELLIAN CITADEL WAS (BEFORE BEING DEMOLISHED), THEN DESIGN MOVED TO PRESENT LOCATION. "ARTILLERY" AND "STAFF" BLOCKS (1762-66); BARRACKS (1757-64); CHAPEL 1763-67	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
SKINNER	COLONEL WILLIAM	DESIGNER	☐
ADAM	WILLIAM	CONTRACTOR, MASTER MASON	☐
ADAM	JOHN	CONTRACTOR, MASTER MASON, MATERIAL SUPPLIER	☐
ADAM	ROBERT	CONTRACTOR	☐
ADAM 1	JAMES 1	CONTRACTOR	☐
MONRO	ANDREW	MATERIAL SUPPLIER	☐
HUNTER	JAMES	MASTER WRIGHT, MATERIAL SUPPLIER	☐
NICHOLSON	ROBERT	WRIGHT	☐
FISHER	JOHN	WRIGHT	☐
GETZEN	ADOLPHUS	WRIGHT	☐
BOODLE	ROBERT	WRIGHT	☐
RUSSELL	JAMES	WRIGHT	☐
WIGTON	JOHN	WRIGHT	☐
LAWSON	WILLIAM	WRIGHT	☐
INNES	HENRY	WRIGHT	☐
MCLAY	WILLIAM	WRIGHT	☐
WIGTON	THOMAS	WRIGHT	☐
REID	DAVID	WRIGHT	☐
MONROE	DONALD	WRIGHT	☐
MCIWIN	JOHN	WRIGHT	☐
WILLSON	ROBERT	WRIGHT	☐
MONROE	ANGUS	WRIGHT	☐
SMITH	JOHN	WRIGHT	☐
GRANT	WILLIAM	WRIGHT	☐

HAY	JAMES	WRIGHT	☐
HOLMES	WILLIAM	WRIGHT	☐
THOMPSON	DUNCAN	WRIGHT	☐
BLACK	DONALD	WRIGHT	☐
FRAZIER	WILLIAM	WRIGHT	☐
ROY	DUNCAN	WRIGHT	☐
MCPHERSON	PETER	WRIGHT	☐
ATKIN	JAMES	WRIGHT	☐
GODDESS	AKEXANDER	WRIGHT	☐
SUTHERLAND	AKEXANDER	WRIGHT	☐
BLACK	JOHN	WRIGHT	☐
DONSKIN	HENRY	WRIGHT	☐
GRAHAM	DONALD	WRIGHT	☐
MURRAY	ROBERT	WRIGHT	☐
SIBBAL	WILLIAM	WRIGHT	☐
YOUNG	ALEXANDER	WRIGHT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CRONE A. & MILLS C.	2008	☑	DENDROCHRONOLOGICAL STUDIES AT FORT GEORGE, ARDERSIER, B INVERNESS	
GIFFORD J.	1992	☐	THE BUILDINGS OF SCOTLAND COLLECTION: HIGHLAND AND ISLAND	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	114
TABRAHAM C. & GROVE D.	1995	☐	FORTRESS SCOTLAND AND THE JACOBITES	92-100

ARCHIVAL REFERENCES

Archive	National Library of Scotland	Doc.Num.	MS 10694	Folios	
Title	Board of Ordnance account book for Fort George				
Archive	National Library of Scotland	Doc.Num.	MS.1646 Z.02	Folios	50a
Title	Plan and Elevations with Sections of the Barracks for 1600 Men and Officers Fort George. By William Skinner (engineer) and Charles Tarrant (draughtsman)				
Archive	National Library of Scotland	Doc.Num.	MS.1646 Z.02	Folios	50b
Title	Plan Elevations and Sections of the North Pile of Barracks Shewing how High they were rais'd in the Year 1754. By William Skinner (engineer)				
Archive	National Library of Scotland	Doc.Num.	MS.1646 Z.02	Folios	47a
Title	Plan Elevation and Section of the Guard House in the Ravelin at Fort George, 1752, No.3. By William Skinner (engineer) and Charles Tarrant (draughtsman)				
Archive	National Library of Scotland	Doc.Num.	MS.1647 Z.02	Folios	55a
Title	Plan Elevation and Sections of the Store-House for Provisions, and Barrack-Masters Stores 1762. By William Skinner (engineer)				

Suggestions for further research: NLS: Board of Ordnance drawings and accounts

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive: National Library of Scotland | Doc. Num.: MS.1646 Z.02 | Folios: 47a
Title: Plan Elevation and Section of the Guard House in the Ravelin at Fort George, 1752, No.3. By William Skinner (engineer) and Charles Tarrant (draughtsman) | Date: from 1752 to
Contents:
Summary and comments:

Archive: National Library of Scotland | Doc. Num.: MS.1646 Z.02 | Folios: 50a
Title: Plan and Elevations with Sections of the Barracks for 1600 Men and Officers Fort George. By William Skinner (engineer) and Charles Tarrant (draughtsman) | Date: from 1753 to
Contents:
Summary and comments:

Archive: National Library of Scotland | Doc. Num.: MS.1646 Z.02 | Folios: 50b
Title: Plan Elevations and Sections of the North Pile of Barracks Shewing how High they were rais'd in the Year 1754. By William Skinner (engineer) | Date: from 1754 to
Contents:
Summary and comments:

Archive: National Library of Scotland | Doc. Num.: MS 10694 | Folios:
Title: Board of Ordnance account book for Fort George | Date: from 1757 to 1759
Contents:

Accounts 1757
Mr Adam master mason
Mr Andrew Monro timber merchant
Mr Hunter Master Carpenter
Mr Burton master glazier
Mr Robertson master smith
Mr Syme master slater
James Gray master smith

Account of materials provided by Mr John Adam for Fort George Preceeding the 1st November 1760 and remaining on the spott for for carrying on the works in 1761
door and window jambs
headers or inbands
window lintels
window stools
chimney jambs
…
steps for stairs
pieces of platform stones
…
unwrought free stone
…
bricks
unburnt lime stone
rubble stone
coal
TOT £ 2460.16
Humbly certified by James Branhom, Arch.d Robertson

Fort George 30th September 1757
A*ndrew Monroe merchant in Inverness* provided 20000 nails
James Hunter master carpenter to this office for North Britain humbly prays allowance of the undermentioned oak sashes and frames by him provided & delivered for the officers & soldiers barracks at this place from the 1st May to 30th September 1757 by order of Colonel William Skinner his majesty's chief engineer for Great Britain
2238 feet of oak sashes and frames with leads, lines & pully – £ 223.16

John Adam does foundations, retaining walls, stone and brick work for walls, chimneys

The slater already did £76 work in 1757

Account of sods cut and laid and carts employed in bringing them from the kirk-town to load the lunettes and covered way

Labourers employed […] pileing timber in the timber yard

smith makes spike nails, cramps -> are they for the timbers? they say *spike nails for scaffolding*

Mr George Fern is paymaster of his majesty's works for North Britain

Fort George 31st October 1757
We whose names are underwritten do hereby aknowledge to have received from Mr George Fern paymaster of his majesty's works for North Britain the particular sums against our names expressed for carpenter work by us performed at the above place in sawing timber, framing principle rafters for the soldiers barracks, fixing the ceiling joists of the centre pavilion, pileing timber, and deals, and enclosing the timber yard, and persons attending shops between the 1st Oc.t 31st instant
Rob.t Nicholson 26 days at 2.6 £ 3.5
John Fisher 31 days at 2 £ 3.2
Adolphus Getzen 26 days at 1.6 £1.19
Rob.t Boodle 26 days at 2 £ 2.12
James Russell 25 days at 1.4 £ 1.134
John Wigton 25 days at 1.4 £ 1.134
William Lawson 26 days at 1.4 £ 1.148
Hen. Innis? 26 days at 1.4 £ 1.148
William McLay 26 days at 1.4 £ 1.148
Thom. Wigton 26 days at 1 £ 1.6
Dav.d Reid 26 days at 1 £ 1.6
Don.d Monroe 26 days at 1 £ 1.6
£ 23.68 TOT

Fort George 30th November 1757
We whose names are underwritten do hereby aknowledge to have received from Mr George Fern paymaster of his majesty's works for North Britain the particular sums against our names expressed for carpenter work by us performed at the above place in sawing timber, and framing of rooffs for the north pile of barracks, and persons attending shops between the 1st November & 30th instant
Rob.t Boodle 30 days at 2 £ 3
Adolphus Getzen 26 days at 1.6 £1.19
Rob.t Nicholson 26 days at 1 £ 1.6
James Russell 25 days at 1 £ 1.5
John Wigton 26 days at 1 £ 1.6
William Lawson 26 days at 1 £ 1.6
Hen. Inniss? 25 days at 1 £ 1.5
William McLay 26 days at 1 £ 1.6
Thom. Wigton 26 days at 1 £ 1.6
Dav.d Reid 26 days at 1 £ 1.6
Don.d Monroe 26 days at 1 £ 1.6
John McIwin 26 days at 0.6 £0.13
£ 19.16 TOT

Carpenters accounts in December 1757 for laying floors of the centre pavilion of the north pile of barracks
same names
TOT £20.12

William Caldwell, James Mercer, Robert Bennett – overseers

Carpenters accounts in January 1758 for *laying floors and passages in the room of the centre pavilion of the north pile of barracks*
same names
TOT £ 20

Carpenters accounts in February 1758 for *repairing and mending wheel-barrows, sawing deals, for the same fixing skirting boards, to the rooms and passages of the center pavilion. Repairing the pump of the well and well-stouse*
same names
TOT £ 18.6

Carpenters accounts in March 1758 for *making doors, jambs, architraves, and sofits, for the rooms of the center pavilion. Sawing timber for joists for the soldiers barracks. Mending and repairing wheel-barrows*
same names
TOT £20.13

Carpenters accounts in April 1758 for *sawing timber for joists for the soldiers barracks. Making doors, jambs, architraves and sofits for the rooms of the center pavilion*
same names

TOT £ 23.168

Carpenters accounts in May 1758 for *sawing timber, framing the roofs of the west pavilion. Hanging doors and fisxing on lockson the doors of the center pavilion*
same names + John Wigton
+ labourers paid to assist carpenters in striking and removing centers at the west casemate and laying the floors of the west pavilion

besides carpenters there is only smith work and John Adam master mason

Carpenters accounts in June 1758 for *saw.g of joists, framing and raising the floors of the soldiers barracks and framing the roofs of the west pavilion*
same names + Rob.t Willson, Jam. Allan, Angus Monroe, John Smith, William Grant, James Hay, Will.m Holmes, Duncan Thompson, Don.d Black, Will.m Frazier, Duncan Roy, Peter McPherson
TOT £ 19.94

Carpenters accounts in July 1758 for *sawing timber for joists, and framing of floors for the soldiers barracks, Making ribs for centers for the magazine and door and window frames for the same. Making hand barrows. Raising scaffolding. Making gangways and repairing tools*
same names + James Atkin, Alex.r Goddess, Alex.r Sutherland, John Black, Hen. Donskin, Don. Graham, Rob.t Murray, William Sibbal, Alex.r Young
TOT £ 43.14

Adolphus Getzen also provides stone, leather, window nails, sprig nails, sheep skin…

Andrew Monro provides nails

John Chiselm provides deals: *1440 single deals 10 feet long at 5… £ 60* – August 1758

Task men and *country men* and *soldiers* employed for minor works and assisting carpenters

Carpenters accounts in august 1758 - £ 39.154
Carpenters accounts in September 1758 - £ 19.14 (they make a gate for the entrance)

Andrew Monro merchant in Inverness supplies *5348 feet solid of square firr timber for girders, tye beams principal rafters, purloins, and joisting for the building £ 312.17 – 50 feet cubical of barr iron £ 4.13*

Carpenters accounts October 1758 for *repairing timber for door jambs and soffits of the west pavilion and making rough shutters for the windows of the same. Making and setting centers for the great powder magazine and covering the same with sheeting boards. Making and hanging the rough gate of the north gateway*
TOT £ 26.12

Carpenters accounts November 1758 £ 22.12
they become less, retaining people from the "first" team
but they always have "task men" and "country men" assisting them

Carpenters accounts January 1759 £ 25.56

Carpenters accounts February 1759 £ 22.7

Carpenters accounts March 1759 £ 26

Carpenters accounts April 1759 £ 27.184

Carpenters accounts May 1759 £ 32.136 *in sawing timbers for rafters and wall-plates for the soldiers barracks*

Carpenters accounts June 1759 £ 31.108 *framing small rafters, roofing the west wing, making a temporary bridge […]*

Alexander Murray merchant provides large axes and hatchets?

Carpenters accounts July 1759 £ 44.17 *laying a temporary floor […] platforms for guns*

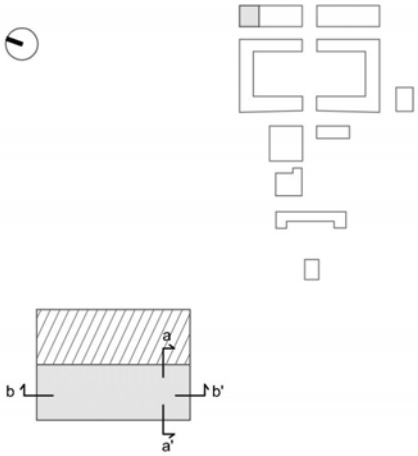
Provided gleu? and oile, sprig nails, ropes, window jacks?

Hugh Falconer merchant provides deals: 564+384+27 single deals 10 feet long 1 ¼ thick – TOT £ 52.13
David Frigge also provides deals: 376 single deals £ 18

Carpenters accounts August 1759 £ 21.19

Carpenters accounts September 1759 £ 16.17 + 24.11 + 21.4 (floor) + 10.10 (doors)

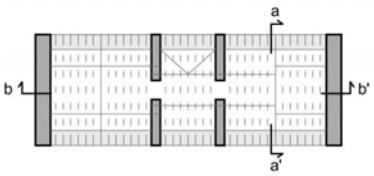
Summary and comments					
Archive	National Library of Scotland	Doc. Num.	MS.1647 Z.02	Folios	55a
Title	Plan Elevation and Sections of the Store-House for Provisions, and Barrack-Masters Stores 1762. By William Skinner (engineer)	Date: from	1762	to	
Contents					
Summary and comments					



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

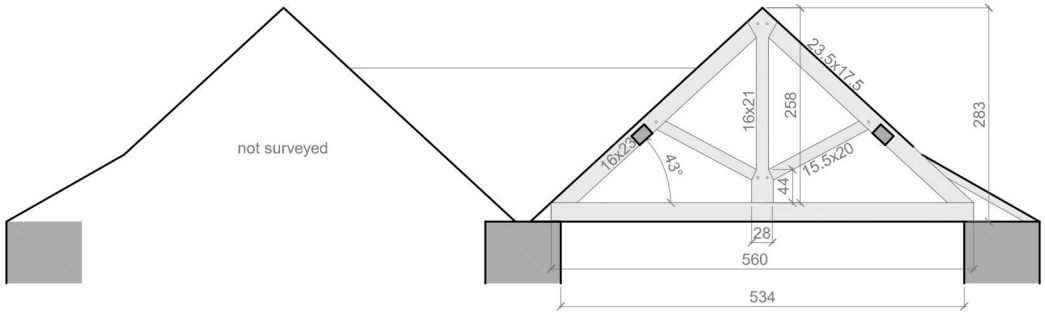
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

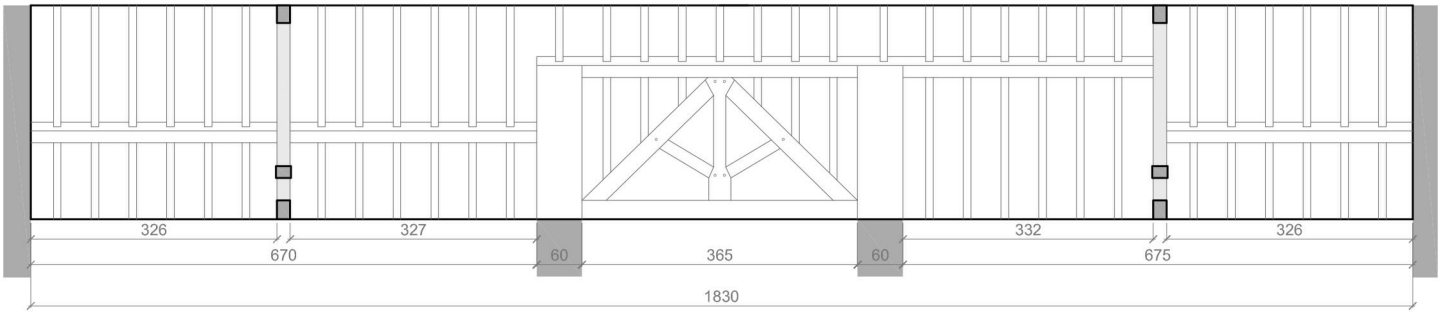
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A

INITIAL SURVEY | **Building name** GEORGE FORT | **Roof location** Museum

Survey date(s) 04/09/2014 | See drawing: GF-M-1

Roof Geometry: M roof, Two-pitch gabled with intersections

Roof Max Span [m]: 5.34 | Roof Height [m]: 2.83

Roof Pitch/es [°]: 43 | Roof Length [m]: 18.3

Type of Primary Structure: 2D framing, Purlins

Truss ☑ KING-POST

Frame ☐

Average Distance in between Primary Structure [m]: 3.25

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tie-beam

Connection with gables:

Roof Construction Period: From 1764 To | Identified by: Estimated

Roof General Description:

Gabled M roof covering a double pile building. Only Western half could be surveyed. Supported by 2 transversal walls not reaching the ridge, 2 king post trusses on the sides and purlins (resting on the intermediate walls) in the middle. Trusses have a tie-beam, a kingpost and 2 slanted struts. There are sprocket rafters on the West side. Smaller king-post trusses support an intersecting roof on the West side. The timbers are well squared, hand axed, with big scantlings. No visible numbering.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 23.5 B: 17.5 | Or Purlin - H: 16 B 23

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: joggle, mortice and tenon

Fasteners Types: Timber dowel

Joints description: All mortice and tenon with timber dowels. The post has joggles.

Wood Species: pinus sylvestris (AOC 2008) | Way of identification: dendrochronology

Carpentry Marks Types:

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure: side sections | link I:\Arch\A



Roof structure: middle section | link I:\Arch\A



Roof structure: intersecting roof | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joints: post, tie-beam and struts | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions

link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	link I:\Arch\A
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

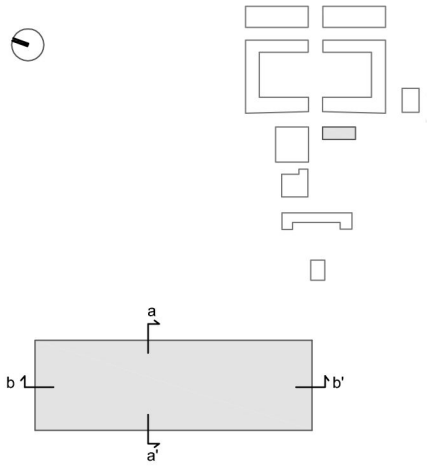
Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes

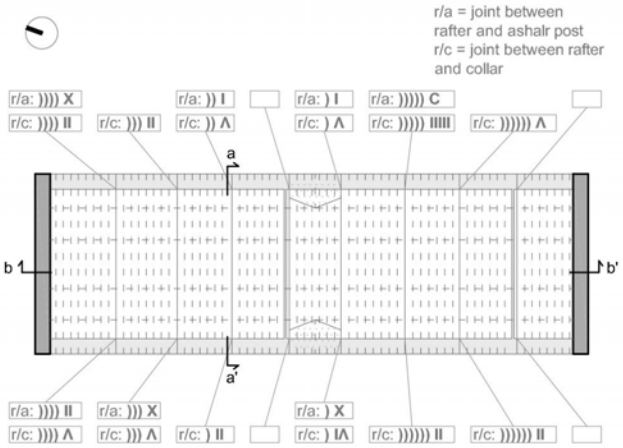
Attachments I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui link



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

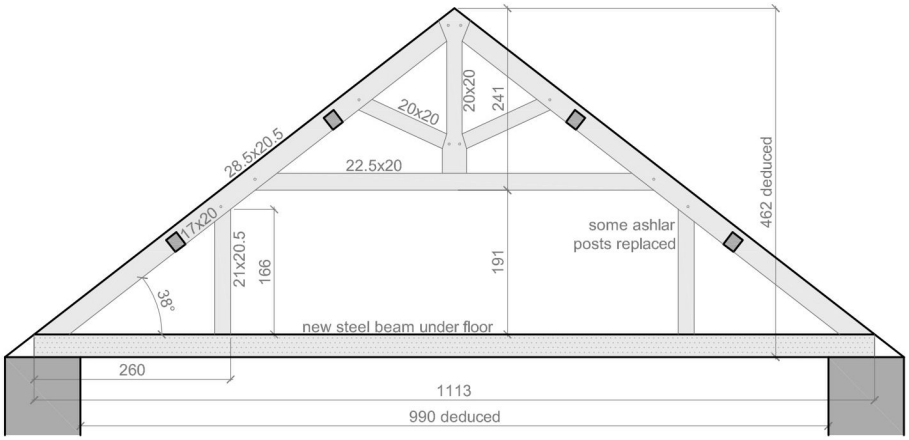
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

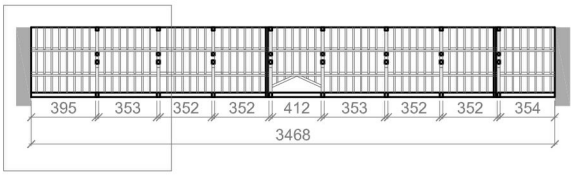
Section aa'

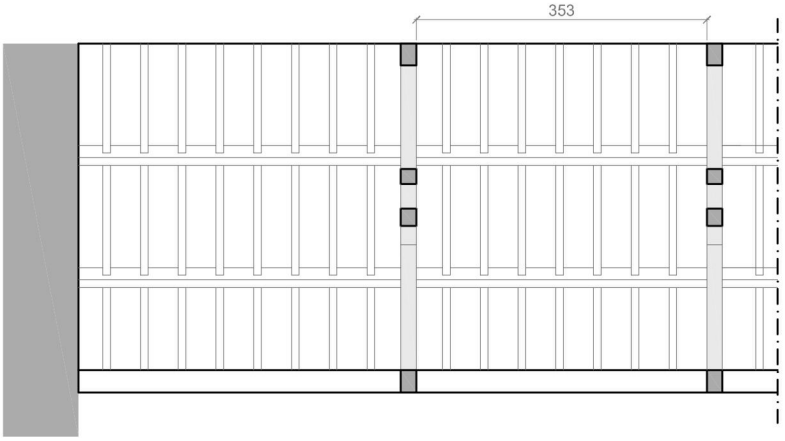


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** GEORGE FORT | **Roof location** South Ordnance Store

Survey date(s) 04/09/2014 | See drawing: GF-SOS-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 9.9 | Roof Height [m]: 4.62

Roof Pitch/es [°]: 38 | Roof Length [m]: 34.68

Type of Primary Structure: 2D framing

Truss ☑ PRINCESS-POST

Frame ☐

Average Distance in between Primary Structure [m]: 3.5

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1759 To 1761 | Identified by: Dendrochronol

Roof General Description: Gabled roof supported by 8 princess post trusses. Trusses have 2 butt-purlins on each side, probably a tie-beam (it is not visible), a collar, 2 slanted struts and 2 ashlar posts. The timbers are well squared, hand axed, with big scantlings. There are some unusual carpentry marks.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 28.5 | B: 20.5 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: joggle, mortice and tenon

Fasteners Types: Timber dowel, Timber peg not flush

Joints description: All mortice and tenon with timber dowels, except for purlins that have timber pegs not flush. The post has joggles.

Wood Species: pinus sylvestris (AOC 2008) | Way of identification: dendrochronology

Carpentry Marks Types: runic marks, small chiseled roman numerals

Carpentry Marks Description: Mix of small chiselled roman numerals and small half circles (from scandinavia?). Some of them are double, on each side of the joint, some of them are put across the members on the joint. There is C next to a joint.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology: dendrochronology carried out on the roof structure by Anne Crone and dated to 1757 (pine from southern Russia, possibly Belarus)



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: post and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☐ Insulation on sarking ☑

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not visible

Past interventions: Some sarking replaced and the two intersecting roofs have all new timbers. Tie-beams replaced with steel beams, not sure if only one or all of them. Checks filled with resin. Some ashlar posts replaced



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐



Damage: disconnection | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage	Disconnection	Unknown	Collateral



Damage: disconnection | link | I:\Arch\A

Estimated cause(s) of the primary damage:

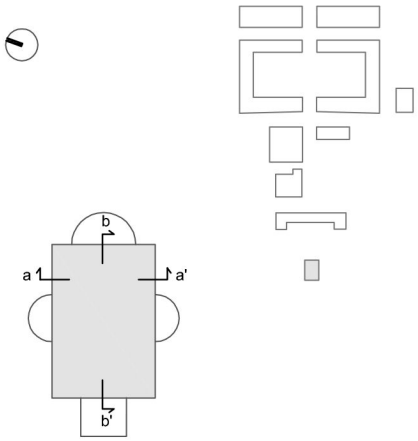
- Poor Design ☑ inefficient joints
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: Joints between ashlar post and rafter are opening. Probably connected with tie-beam deflection, which is probably why tie-beam has been substituted.

link

Other Notes

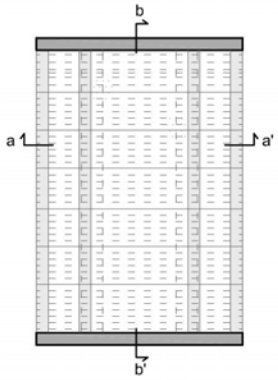
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Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

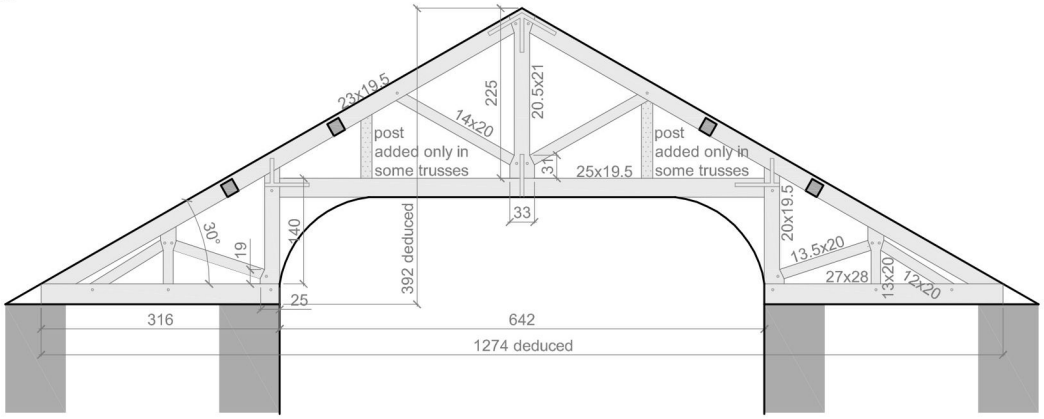
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

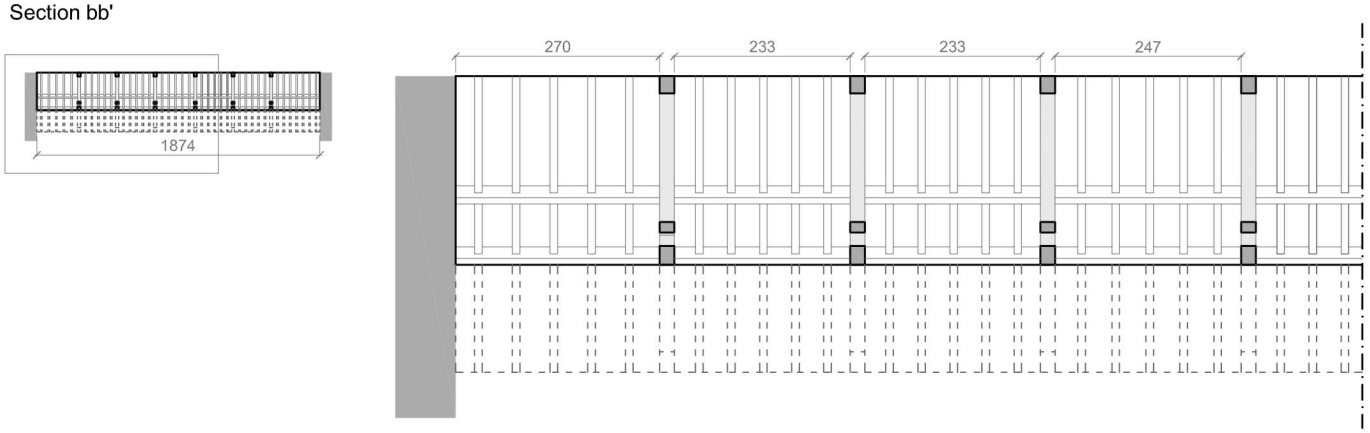
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** GEORGE FORT | **Roof location** Chapel

Survey date(s) 05/09/2014 | See drawing: GF-C-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.42 | Roof Height [m]: 3.92

Roof Pitch/es [°]: 30 | Roof Length [m]: 18.74

Type of Primary Structure: 2D framing

Truss ☑ PRINCESS-POST

Frame ☐

Average Distance in between Primary Structure [m]: 2.5

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tie-beam

Connection with gables:

Roof Construction Period: From 1763 To | Identified by: Dendrochronol

Roof General Description: Gabled roof supported by 6 princess post trusses that sit on the lateral walls and intermidiate columns. Trusses have 2 butt-purlins on each side, 5 posts and slanted struts supporting the tie-beam interrupted by the curved ceiling underneath. The timbers are well squared, hand axed, with big scantlings. No visible numbering.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 23 B: 19.5 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: joggle, mortice and tenon

Fasteners Types: Metal strap, Timber dowel

Joints description: All mortice and tenon with timber dowels. Metal stripes at rafters' apex, between the upper post and the collar and between the lower posts and the collar. Posts have joggles.

Wood Species: pinus sylvestris - 1 kingpost spruce (AOC 2008) | Way of identification: dendrochronology

Carpentry Marks Types:

Carpentry Marks Description: Not visible

Signs of reused timbers:

Timber Treated ☐

Other Materials: Metal straps in some joints

Dendrochronology: dendrochronology carried out on the roof structure by Anne Crone and dated to 1762/64 (pine from Karelia, a region spanning the modern finnish/russian border and close to St Petersburg)



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joints: post and tie-beam | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: Original plaster ceiling underneath

Unfavourable conditions: poor ventilation

Accessibility limitations:

Past interventions: Some common rafters and sarking replaced



Past interventions | link | I:\Arch\A



Material degradation | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☐

Humidity stains on sarking, common rafters and purlins. Insect attack on purlin, not sure if active

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

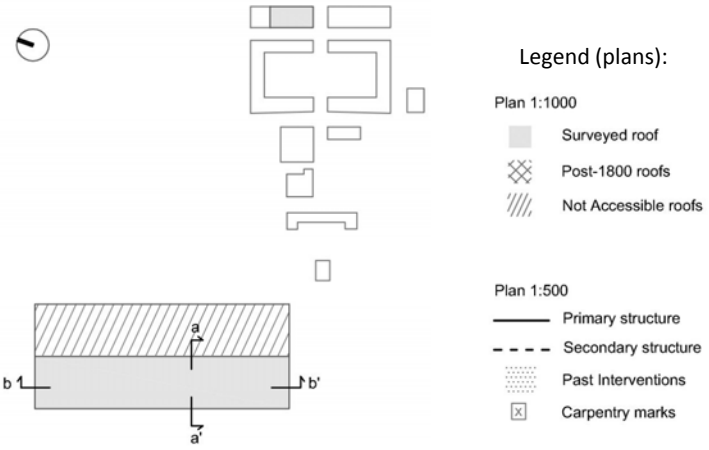
Estimated cause(s) of the primary damage: | link | I:\Arch\A

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

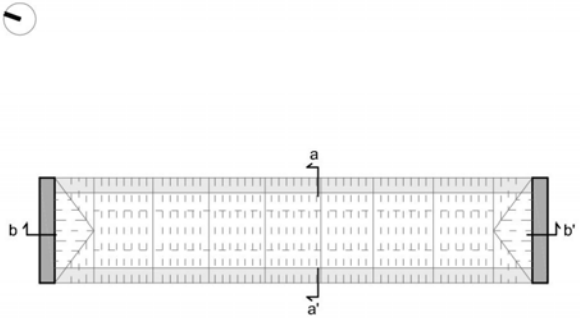
Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

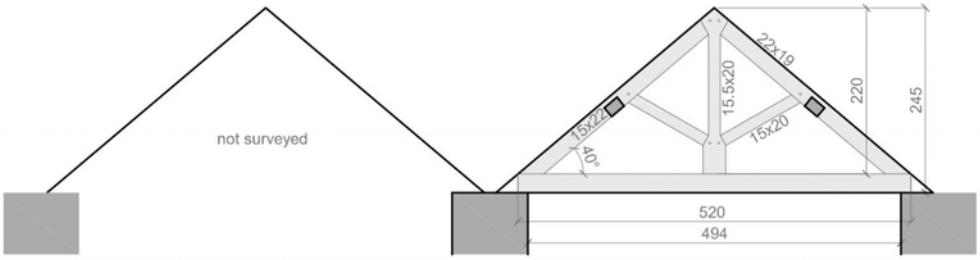


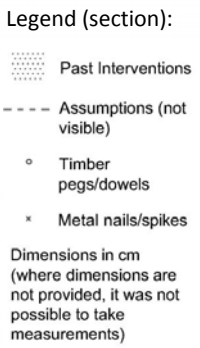
Plan 1:1000 I:\Arch\ADCRU\1718cent scott



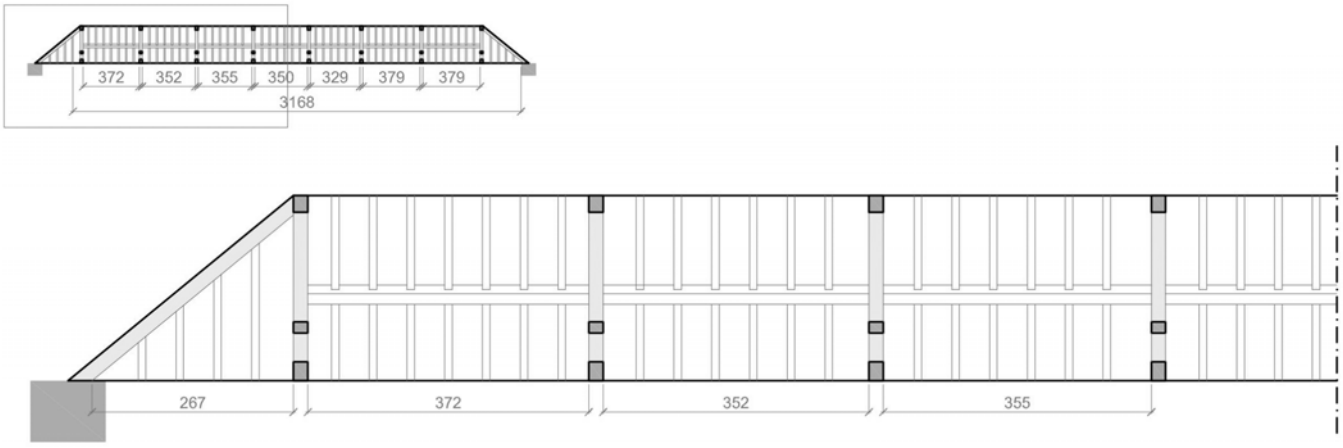
Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'





Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b





Roof from outside I:\Arch\A



Roof from outside I:\Arch\A

INITIAL SURVEY | **Building name** GEORGE FORT | **Roof location** Staff block

Survey date(s) 04/09/2014 | See drawing: GF-SB-1

Roof Geometry: Hipped, M roof

Roof Max Span [m]: 4.94 | Roof Height [m]: 2.45

Roof Pitch/es [°]: 40 | Roof Length [m]: 31.68

Type of Primary Structure: 2D framing

Truss ☑ KING-POST

Frame ☐

Average Distance in between Primary Structure [m]: 3.5

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tie-beam

Connection with gables:

Roof Construction Period: From 1762 To 1764 Identified by: Dendrochronol

Roof General Description:

Hipped M roof covering a double pile building. Only East roof could be surveyed. It is supported by 8 king post trusses with a butt-purlin on each side (in some sections there is a second purlin). Trusses have a tie-beam, a kingpost and 2 slanted struts. The timbers are well squared, hand axed, with big scantlings. No visible numbering.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 22 B: 19 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: joggle, mortice and tenon

Fasteners Types: Timber dowel, Timber peg not flush

Joints description:

All mortice and tenon with timber dowels, except purlins that sometimes have timber pegs not flush. The post has joggles

Wood Species: pinus sylvestris (AOC 2008) | Way of identification: dendrochronology

Carpentry Marks Types:

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:

dendrochronology carried out on the roof structure by Anne Crone and dated to 1762-1764 (pine from Karelia, a region spanning the modern finnish/russian border and close to St Petersburg)



Roof structure link I:\Arch\A



Roof structure: hip rafter link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: rafter, strut, purlin link I:\Arch\A



Joints: rafters' apex link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation

Accessibility limitations

Past interventions

link

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	link
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui link

GEORGE HERIOT'S HOSPITAL SCHOOL

Location	EDINBURGH, CITY OF	EDINBURGH (EDINBURGH, CITY OF)	
X coordinate	325485	Y coordinate	673186
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PRIVATE		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	52134
Original Use	Hospital, School		
Current Use	School		

Freestanding ☑ N. of floors above ground level 4 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1628	1631	PLAN CHOSEN BY GEORGE HERIOT: PALACE IN SERLIO'S 7TH BOOK OF ARCHITECTURE (1550); WORKS STARTED AT THE NORTHWEST TOWER AND REACHED THE FIRST FLOOR WHEN WALLACE DIED IN 1631	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
MURRAY	SIR JAMES	ARCHITECT, ROYAL MASTER OF WORKS, WRIGHT	☑
HERIOT	GEORGE	COMMISSIONERPATRON	☐
WALLACE	WILLIAM	DESIGNER, ROYAL MASTER MASON	☐
AYTOUN	WILLIAM	ROYAL MASON	☐
DAVIDSON	ANDREW	OVERSEER	☐
ROBERTSON	DAVID	MATERIAL SUPPLIER	☐
BANNATYNE THE YOUNGE	JAMES	MATERIAL SUPPLIER	☐
GILBERT	JAMES	MASON	☐
SHORT	ROBERT	MASON	☐
MACMATH	JAMES	OVERSEER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION, CONSTRUCTION	1631	1647	CONSTRUCTION CONTINUED BY WALLACE'S ASSISTANTS. IN 1633 THE CHAPEL ROOF WAS COVERED IN LEAD. LEAD OGEE ROOFS ON THE TWO NORTH TOWERS WERE DISMANTLED AND REDONE FLAT, AND THE ATTIC BETWEEN THEM BUILT UP IN 1642. NORTH RANGE ROOF WAS REDONE FLAT BEFORE 1647	LOCKHART 2009

People involved:

Last Name	First Name	Role	Attributed
AYTOUN	WILLIAM	CONTRACTOR	☐
WATT	JOHN	CONTRACTOR, MASON	☐
CORNELISONE	PETER	MATERIAL SUPPLIER	☐
BLAND	JOHN	PLUMBER	☐
MYLNE	JOHN JUNIOR (3)	MASTER MASON	☐
HAMILTON	JOHN	MASON	☐
STIRLING	JAMES	MASON	☑
SCOTT	JOHN	WRIGHT	☐
BUCHGUHANNAN	JOHN	WRIGHT	☐
LAUDER	HENRY	WRIGHT	☐
HERIOT	JOHN	WRIGHT	☐
HERIOT	JAMES	WRIGHT	☐
HERIOT	GEORGE	WRIGHT	☐

CRYSHE	JAMES	WRIGHT	☐
WATSON	THOMAS	WRIGHT	☐
JOHNSTONE	JAMES	WRIGHT	☐
RIDDOCH	JAMES	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1648		TAKE DOWN THE SOUTHWEST TOWER ROOF AND REBUID IT FLAT AS THE NORTH ONES	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
SCOTT	JOHN	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1649		TAKE DOWN THE SOUTHEAST TOWER ROOF AND REBUID IT FLAT AS THE OTHER ONES	LOCKHART 2009

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1659		REPAIRS AFTER RAINSTORMS	LOCKHART 2009

People involved:

Last Name	First Name	Role	Attributed
MYLNE	JOHN JUNIOR (3)	MASTER MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1673	1683	CHAPEL REPAIRED BUT WALLS LEFT BARE AND ROOF LEFT WITH NO ORNAMENT. MATERIALS FROM DISMANTLED KIRK AT CROMWELL'S CITADEL IN LEITH WERE USED.	LOCKHART 2009

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION, DESIGN	1675		TOP OF THE ENTRANCE TOWER	LOCKHART 2009

People involved:

Last Name	First Name	Role	Attributed
MYLNE 1	ROBERT 1	CONTRACTOR, DESIGNER	☐
SMITH 1	JAMES 1	CONTRACTOR	☐
BRUCE 1	SIR WILLIAM 1	ARCHITECT, DESIGNER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1683	1684	WRIGHT WORK IN CHAPEL AND SUMMER HOUSE	NRS GD421/10/68

People involved:

Last Name	First Name	Role	Attributed
SANDILANDS	THOMAS	WRIGHT	☐
OGSTOUNE	JOHN	WRIGHT	☐
MILLAR	JOHN	WRIGHT	☐
WILSON	THOMAS	WRIGHT	☐
CHYRMSYD	THOMAS	WRIGHT	☐
MARSHALL	WILLIAM	WRIGHT	☐
STEWART	GEORGE	WRIGHT	☐
POTTAR	WILLIAM	WRIGHT	☐
SCOTT	JOHN	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1684		REPAIRS TO SOUTHEAST AND SOUTHWEST QUARTERS	LOCKHART 2009

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1727		REPAIRS TO EAST SIDE FOR £200	LOCKHART 2009

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1762	1765	ENTRANCE AVENUE AND STEPS	LOCKHART 2009

People involved:

Last Name	First Name	Role	Attributed
ADAM	JOHN	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1787		CHAPEL REFITTED WITH ADAMESQUE CEILING INSERTED	LOCKHART 2009

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1833		NORTH FRONT REDONE IN ASHLAR: SIX INCHES WERE REMOVED FROM THE WALLS AND REPLACED BY HEWN STONE - THEY EXPERIMENTED THE TECHNIQUE BEFORE ON THE RECEDING PART OF THE SOUTH FRONT	LOCKHART 2009

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1834	1836	INTERIORS OF CHAPEL REDONE, CEILING INCLUDED	LOCKHART 2009

People involved:

Last Name	First Name	Role	Attributed
GRAHAM	JAMES GILLESPIE	ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	138-155
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	74
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	67, 88
HANKE T.	2004	☐	THE STABLE OF HALKERSTON LODGE AND MORAY HOUSE - ROOF ARCHITECTURE OF THE 1630S AROUND EDINBURGH	
LOCKHART B. R. W	2003	☐	JINGLIN GEORDIE'S LEGACY: A HISTORY OF GEORGE HERIOT'S HOSPI SCHOOL	
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	9
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	4
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 105, 106

ARCHIVAL REFERENCES

Archive	National Records of Scotland	Doc.Num.	GD421/5/2	Folios	
Title	Heriot's Hospital Treasurer's Accounts				
Archive	National Records of Scotland	Doc.Num.	GD421/10/68	Folios	
Title	Account of wright work in George Heriot's Chapel and summer house by Thomas Sandilands				
Archive	Private: school archives	Doc.Num.	Uncatalogued drawing	Folios	
Title	George Heriot's School. Proposed additional class rooms. Plan and sections showing the roof of the East and West ranges.				
Archive	Royal Commission on the Ancient and Historical Monuments of Scotland	Doc.Num.	DP 055037	Folios	
Title	Sections through quadrangle including interior elevations of chapel, dining hall and classrooms. Title: 'GEORGE HERIOT'S HOSPITAL EDINBURGH'.				
Archive	National Records of Scotland	Doc.Num.	GD421/5/3	Folios	
Title	Heriot's Hospital Treasurer's Accounts 1642-1652				
Archive	National Records of Scotland	Doc.Num.	GD421/5/4	Folios	
Title	Heriot's Hospital Treasurer's Accounts 1652-69				
Archive	Royal Commission on the Ancient and Historical Monuments of	Doc.Num.	D.8.41.HER.P	Folios	

	Scotland				
Title	Heriot's Hospital - a short history by D. PRYDE. Extracts from minutes of George Heriot's Trustees. Special articles commemorating the 350th anniversary of the laying of the foundation stone, from the HERIOTER July 1978				
Archive	Private: school archives	Doc.Num.	Uncatalogued reports	Folios	
Title	Reports on repair works carried out on the roofs of George Heriot Hospital				

Suggestions for further research

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive National Records of Scotland | Doc. Num. GD421/5/2 | Folios

Title Heriot's Hospital Treasurer's Accounts | Date: from 1633 to 1642

Contents

** Nov. 1633 - Nov. 1634 William Cochrane
??? William Cochrane his compt of his ??? ??? ??? ??? ??? ??? and ??? particularis belonging to ??? charge heriof his hospital? ??? the treheme? day of November 1633 ????????? day of November 1634 ???
Charge
The compter charged himself with the ?primll? ??? and ?????????????
Imprimis the compter charged himself with that ??? afterward ??? ??? ??? the said hospitall at the fitting of ??? said compt ??? ??? ??? the ??? day of aprrril 1634 ??? ??? be the said ?????????????
??? the 22 of November 1633 ??? from ??? lord ??? the address of ?????? if 5000 markis from ??? 1632 to ??? 1633 the ??? ???
[…]
??? the said day from Jon smyth of ???
[…]
Com? the said day from Johne Gorddonthe name of the lord ??? the amount? of 2000 tib ???????? 1633
???? 20 Januray 1634
James ???
Johnestone
Thomas???
??? Murray
[…]
Icom the compter charged himselff of the formis and feynil of the ??? of ??? ??? to the said hospital ??? ??? 1633 ??? they are fet and ????????? following
[…]
I com the compter charged himself of that after he has ressamto
Discharge
Followes the said William Cochrane his ??? of his intcoming soum With the ??? Srm.ll ??? and by Eis ??? and ??? ??? ??? be hime and payit and debursit be hime to ??? during the tyme forsaid ??? according to the particularis following
Imprimis ??? the fyift day of december 1633 lent to my lord ??? and his band bearis
*Item the sayt of december to **Johne hamiltoun of orbefton** and his ??? conforme to the band*
Item the same day and ??? ??? of Juny 1634 to Jonat ??? ??? to Charge ??? be yave mertunes ??? ??? 1633 and witsenday 1634 ??? be yave discharges
*Item ??? the feift day of februar **payit to Johne Jonsso in name of maister John Jonstone** of ??? ??? the ??? of ??? the said ??? ??? him from the ??? and ??? of mertimes 1632 to ??? 1633*
Item the ??? day of Juny lent to ??? ??? ??? his twa band bearis
Item the 18 of Juny lent to the lord ??? conforme to the band maid be him and his ??? yairanents
*Item payit to the laird of ??? and ??? oliphant ??? clerk **in name of Jon Scott** sumtyme of discharge for the ??? of ??? ??? arboris of laird ??? brighton ??? be ??? from the said Jon Scott ??? ??? the ??? and to his ??? at the ??? ??? ??? ??? consent ???????????*
Item ??? lent to the guard house of ??? at nortsonday 1634
The compter is ??? dischairgis of the particularis Debursit be him forgone the ??? and building of the hospitall and persone ??? materialls & ??? as followes
*Item forgone the 16 day of november the 1633 this compt of the ??? **maissones to Jon wat***
Item ??? may ??? fyve dayes and ane halfaday ???
*Item to **Albert sehortson** ??? and ??? gray all and haill ??? at ??? the peice ???*
*Item to **Goerge Stirling** ??? cunyinghame **James aytoun** ??? prestone ??? ???day menzes James ???sone Jon ??? ??? George honeymane Jon pillones ??? ??? all ??? and haill ??? at ??? the peice*
Item to ??? ??? ??? and to thomas ??? 5 days and ane half at
*Item to Michel ??? **jon thomsone James broun James Stirling Jon Hamiltoun Thomas gairdiner jon cunynghame** ??? ??? ??? barne **Simeone barrie thomas greay** and ??? all at all 12 ane haill ??? ???*
*Item to **Johne porteous** five dayes at ??? the day*
*Item to **James home** and **Jon hamiltoun** ane haill ???*
Item to wm wallace ane ???????
Item to patrick ??? and ??? patersone ane haill all
Item to James guhyte???
[...]
Item the 23 of no? 1633 to Jon ????????
*Item to ??? and **Jon bryce** ane haill all*
*Item to ??? 5 dayes and ane halfaday ??? cunynghame **Ja? aytoun** James ??? ??? ??? **Johne menzers** ??? maine James ??? ??? ??? ??? ??? **George homeyman** ??? ??? **wam aytoun** all and haill ???*
Item to wam aytoun ??? haill ???
*Item to Mitchaell ??? **Jon Thomsone** James ??? **Jon porteous Jon hamiltoun Thomas gardener Jon cunynghame** ??? ??? ??? **Symeone Barry Thomas Greay** and ??? ??? all ane haill ??? at 54s. the peice ???*

*Item to **James home** and **Jon hamiltone** and ???*
*Item to **wam wallace** ane day*
*Item to **Jon Pillones** ane haill ???*
*Item to **patrick cullane** and ??? patersone ??????*
*Item to **Jon Gairdner** James ??? **patrick witherspune** Jon ???rsone **James Stirling** ??? twa ogeris rabattis and Thomas ??? ??? and ???*
Item to Williame ??? for ??? of 20 ??? ??? ??? jon ??? 15 James ??? henrie ??? 16 and ??? ??? 6 ??? 93 ???
Item to Ja? ??? and Jon ??? ??? & ??? at 6 ???
Item to ??????????????
*Item to **James Walmate** and ??? Jamiesone*
*Item to **Jon Ronald** ?????????*
Item for 37 ????????
[...]
*Item to **Williame mure** and Johne ??????????*
[...]
*Item to **George Duncane** and **George ramsay** ????????*
Item the ??? of november ?????????
*Item to **Albert gray** ??? ??? and **Jon bryce** ???????????*
*Item to **wam aytoun** and ???*
*Item to ??? ??? ??? cunynghame **wm aytoun** thomas ??? ??? ??? ??? **James cuthbertsone** Jon ???ahie **James finart George honeyman Jon pillones** and **wam aytoun** all and hailll ane ??? ???*
Item to ??? ??? Jon thomson James broun Jon Porteous thomas gardner ??? ??? Symeone barry thomas greay and ??? abbott all haill ane haill ??? at 54 ???
Item to Jon hamilton and Jon cunynhame ??? ane 5 days at 9 s ??? day
Item to James home and Jon hamilton and haill ??? at 48 s the peice is
Item to wm wallace and ???????
*Item to patrick cullane and haill ??? 24 s and to **Albert patersone** ane day ???*
Item to ??? ??? James ????????? [...] Thomas ???????
*Item to **James Stirling** and ??? ??? patrik witherspune **Jon hamiersone** and Jon ???????????*
Item to Thomas abeel ??????
[...] Jon Ronnald [...] Jon maissone
Item the ??? 1633 to Jon ??? 5 days and ane half
Item to wam aytoun 5 days and ane half at 26 s a day
Item to Habert ??? ??? and Jon bryce anie ???
Item to (six) twelf maisones and ??? ???
*Item to ??? ??? James aytoun thomas ??? **Hobert preston** Jon ??? and James finart 5 days ane ??? and **Jon ritchie** ane day at ???*
Item to twelf maisons all ane haill oulb? at 54 s. the peice
Item to Jon hamilton and James home ane haill oulb? at 48 s. the peice is
Item to wam wallace ane haill oulb 40 s. and Jon pillones 30 s.
Item to patrick allane and Ho.t Patersone ane ??????
*Item to **James beng**? for hewing of 19 ornells wam meyie 21 **Ho.t algare** 21 Johne clarl??? and **henrie cubersone**? 23 ????????????? ornellis at 3 s. 4 d. the peice*
Item to James Stirling for hewing of 5 ogeris James pitte??? patrick witherspune 2 wam ??? 2 Jon handersone 2 Jon gardiner ??? and thomas abell 2 the of all ogeris at 30 s. the peice
Item to James broun Symeone barrie and thomas gray ??? twa rabettis a peice at 30 s.
Item to Jon ??? 3 rabettis thomas ??? twa and Holbert all of ane the os all for rabett at 26£ day
Item to Johne craufurd for hewing of ten ??? James ??? 8 ??? 8 and wan ??? in all 33 at 6s. 8 d.
Item to 5 ??? ??? for hewing of fyve orna??? at 3 s. 4 d. the peice
Item to 4 workmen ane haill oulb at 30 s. and ??????????????
[...] 60 laid walstones [...]
Item to Johne maissone and wam mure ??? 4 futis and 6/3 ??? at 3s. 4d.
[...]
Item the 14 of december to Jon ???????????
Item to Ho.t ??? ??? ??? and Jon bryce all ane haill ??? at 4 ???
*Item to ??? ??? ??? cunynghame James aytoun Thomas ??? Hobert preston **Johne menzers** ??? ??? Thomas gray ??? ??? ??? George honeyman ??? ??? Jon pillones ??? ??? aytoun all ane haill ??????*
*Item to Michaell ????????????????????????? Jon cunynghame ???????? Thomas gray and **Ho.t abbot** all ane haill oulb? at 54 s. the peice is*
Item to James home and Jon hamilton ane haill oulb at ???
Item to william wallace ????????
Item to ??? ??? and Ho.t prestone ane haill oulb at 24 s. is
*Item to Johne ??? James stirling James ??? James witherspune **Jon hendersone** Jon gardiner and Thomas ???????? hewing ??????????*
Item to ????????????? jon wat ??? ??? paid for hewing of ??? ornellis ?????
*Item to **Ho.t waterstone** James beng and Jon ??????????????*
Item to Thomas ??? ??? wam mure williame adame for hewing of 30 ??? at 6 s. 8 d. the peice is
*Item to **wam portens** and wam ????????*
Item to 4 workmen ane haill oulb at 30 s. and to ane ??? 36 s.
Item to James ?abmath and ?????????????
Item the ??? of ??? to Jon ??? and wam aytoun ???
Item to Ho.t ?hart Ho.t gray & jon bryce ane ???

Item to ??? ??? George stirling ??? cunynghame James aytoun ***Thomas amshe****? Hobert preston Johne menzers ??? meme James cuthberstone George honeymane Jon pillones Johne ?tthie and wam aytoun all ane haill oulb at ??? the peice is*
Item to ??? ??? ??? finairt jon thomsone James broun jon portens jon cunynghame ??? hayre ***peter hirne*** *Symeone barry and Thomas gray all ane haill oulb at ??? s.*
Item to thomas gairdner ?????????
Item to James home and jon hamiltone ane ???????
Item to wam wallace ane haill ??? and jon pillones
Item to patrick ?allane and Ho.t patersone ane haill ???????
Item to Ho.t ellot? ane haill oulb?
Item to James stirling jon hendersone thomas ??? ??? ?stone James beng? and ***jon clerk*** *for hewing of ??????????*
Item to jon gardner for hewing ?????????????
Item to Johne amishe wm adame ??? wam meme Ho.t ??? and ???????????
Item to ??? ??? for hewing 17 ornell jon ??? 17 henrie ??? 15 thomas ??? 16 ????????
Item to johne hamiltone ??? ??? for hewing 3 ??? at 48 s. is
Item to ***wam porteous*** *??? ??? James pitter??? and patrick witherspune ??????? at 48 s. the peice is*
Item to James pitte??? and patrick witherpune ????? scuncheones?
Item to jon clerk for 4 scumchenes? ????????
Item to 4 workmen ane haill oulb ??? 30 s. and ??? ??? 36 s. is
Item to ***james washmath****? and ??? ???*
Item to ***jon ronald*** *??? 4 teansomes? at 24 s. and 27 fute ??? at ??? s. is*
Item for 26? fute 19 ??? and 4/3 ??? the fut
[...]
Item to Jon maissone and wam mure ??? 4/3 ???
Item to ??? ??? for 63 fut & 34 fute at ???
Item to George duncane and ??? ??? for 53 futs and 2 ???????
Item the 28? of dec? to jon watt 3 days at 16 s. 8 d. the day
Item to wme aytoun twa dayes at 20 s. ???
Item to ??? ??? 5 days Ho.t gray? and ??????????
Item to George stirling? ??? cunynghame George honeyman Jon pillones ??? ??? 5 days at ???
Item to ????????? Ho.t preston ??????? and James cuthbertsone ??????
Item to James aytoun ??? ??? wm aytoun all a ???
Item to john thomsone ??? ??? and ***Ho.t ellot****? ?????????*
Item to Michell ??????? finairt James broun jon porteous jon cunynghame & thomas gray ??? 4 days at 9 s. the day is
Item to peter/patrick burne and symeone barry ??? ane 2 days at 9 s. the day is
Item to James home ??? jon hamiltone 5 days ???
Item to wam wallace 5 days at 6 s. 8 d. & jon pillones ??? days at ??? s.
Item to Patrick ?allane and Ho.t patersone 5 days at ??? s.
Item to Johne hamiltone for hewing of ????????? and ***James craufurd*** *??????*
[...]
Item to George duncane for 63 futs at 3 s. 4 d. ???
Item the 4 of january 1634 to Jon watt ane haill ???
Item to wam aytoun ane ??? 4 dayes
Item to Ho.t ??? Ho.t gray & jon bryce all ane haill ???
Item to ??? ???George stirling G??? cunynghame Thomas anishe
James Aytoun 5 days and a half at 10s.
John Thomson, John Cuningham, Symeone Barry, Thomas Gray *ane haill oulb at 54 s.*
David Finairt 5 days, Thomas Gardiner and John Porteous 4 days.
James Home and John Hamilton *ane oulb at ??? s*.
William Wallace *ane haill oulb at 40 s.* and John Pillones *??? s.*
Patrick Allane.
Patrick Witherspun.
John Gardiner, **William Adam** at 30 s.
William Adam at 26 s.
James Beng 48 s.
John Clerk.
John Hamilton.
William Porteons.
William Dyne, **Hobert Henrieson**.
John Ronald *for ane fute ne wall and ??? 6 fute lym wall.*
Item for 34 futes and 33 fute stones at ???
George Ramsay.
5 workmen.
James Mabmath sand?.
1634 Jon Watt 5 days.
Hobert Schort?, Hobert Gray, John Bryce 5 days at 5 s.
James Aytoun, Thomas Anishe, Hobert Prestoun, John Pillones, William Aytoun *all ane haill oulb at £3.*
George Stirling, **Gawne Cuningham**, George Honeyman all 5 days and a half.
William Aytoun.
Michael Drybrugh, David Finairt, John Thomson, James Brown, John Porteons, John Cuningham, Symeone Barry, Peter Burne, Thomas Gray *all ane haill oulb at 54 s*.
Hobert Abbot 5 days and a half a piece at 9 s.

John Hamilton *ane haill oulb at 48 s.*
William Wallace 40 s. and John Pillones 30s.
Patrick Allane.
William Porteous, **William Meme**, William Adam.
John Hamilton.
John Anishe.
John Henderson.
William Dyme, John Gardiner, **Step. Waterstone** *ane haill at 48 s.*
John Beng 2 scuncheones at 30s. the peice.
Henrie Cubersone 15 ornell at 3s. 4d.
James Mathmath.
John Ronald *ane 7 fute sconnes? 30 s. and ane garit? lyntell 24 s. and 33 fute 12 s.*
Item ??? and 7 fute newall and ane 7 fute ??? wt ane 6 fute transone at 18s.
John Morisone.
William Mure.
1634 to John Watt *ane haill oulb.*
William Aytoun.
Hobert Gray.
John Bryce 5 days.
Item to ten morisons all ane haill oulb at ??? the peice is.
Gowan Cuningham, James Aytoun, George Hennyman 5 days at 30 s.
maissones 54 s. the peice.
William Wallace 40 s. and John Pillones 30 s.
Patrick Allane, **Robert Paterson**.
[…**** Nov. 1634 – Nov. 1635 William Cochrane**
At the end:
1628 to 1635 – *£ 72000 for timber from Norway*
on the fabric £ 101308 : £ 11436 in 1628, £ 10500 in 1629, £ 12147 in 1630, £ 960 in 1631, £ 11001 in 1632, £ 19428 in 1633, £ 18398 in 1634, £ 24185 in 1635
**** Nov. 1635 – Nov. 1636 Robert Flemyng**
**** Nov. 1636 – Nov. 1637 Edward Edgar**
p. 79: *The compter discharged himselff with the moneyis susteyit and debursit be him forgone the buying of treis and dailles to the hospital the ??? of acoompt as follows*
Imprimis to peter? Cornelisone for? twa hundreth and seavin grait treis boagt be him in norroway for the rofe? of the hospitall conforme to and aggreement maid betwyx him and Jon Edgar and me be the adbyse? of James rychard the ??? to the guid ??? Thomas meire? and James guthrie? conforme to his compt debyberis to me with ??? amounting to twa hundreth feifte ancht ??????
Item payit to him also for 20 fathome burne wod and 5 dussone spares to fill ??? the ship ?????????
Item for fraucht? of the said ??? and hazard after? the ??? being his owne money supleyed forgone his awn? ??? & till his debybrie of the ??? at ??? twa hundreth fourtie twa ?????
Item for the charges of the said timber to the workemen that careit and laid the same ?????? and ane half ???
**** Nov. 1637 – Nov. 1638 Thomas Chairteris**
Followes the said Thomas Chairteris his discharge of his incomissone? w.t the ?rents ??? soumes and ?????????? with be him and apayit and debursit be him be him to sundrie persones during the tyme forsaid according to the particularis following
Imprimis payed to Cargo ??? ??? for his ??? ??? ??? 1637 and ??? anno 1639 conforme to his discherge
Icom to Cristiang heriot for his ??? ?? from November 1637 to November 1639 Conforme to his discharges
Icom to Jonac? macdull? the mercumes? ??? ??? 1637 and ??? 1639 of 5000 merkis
Icom to Cristane blaw? for the ??? ??? at 50 tib. in the ???
Icom to payit to Johne? bland? plumber conforme to the compell warrand
Icom to Johne Jonse? in name of ??? Albert Johnestonn ??? for the ?? of 6000 tib. ??? to him from ??? 1636 to ??? 1637
Icom lent? to the ??? of ??? Carrieson ??? to his band
Icom lent? to ??? ??? conforme to his band
Item to ??? ??? ??? ???????? conforme to his discharge
Item payit to patrick Cashelait? the ??? sundrie tymes conforme to his discharges ??? to me ??????????
The compter ??? to the dischargit of the particularis debursyt be him forgone the fabrick and building of the hospitall and provisone? and materiallis ??? as followes
Imprimis forgone the ??? day of november 1637 to jon watt 5 £ wam aytoun 6 £ and Hobert sohirt? 5 £
Item John menzers George Stirling ***patrick pringle*** *and Mathew witherspune ??? ??? ??? ane oulb at 3 £ the peice is*
Item to James ??? wam ??? james broun johne guthrle? Johne gairdner Ho.t ellot and Johne henriesone ??? ane of ??? and oulb at 54 ??? the peice is
Item to James cuthbertsone wam ellot George ran??? and wam ??? at 2 £ 10 s. the peice
Item david ??? 48 s. ??? ??? ***Johne edgar Ho.t banmebe and slep. baillie*** *??? ane of yame? at 40 £ the oulb is*
Item to ***Ho.t aytoun***
William Stirling.
seven workmen.
George Wade.
James Mabmath.
John Ronald.
John Watt, William Aytoun.
George Stirling, Patrick Pringle, Mathew Witherspun.
[...]

John Watt, William Aytoun,.
George Stirling, Patrick Pringle, Matthew Witherspun.
John Watt, William Aytoun, John Menzers, George Stirling, Patrick Pringle, Matthew Witherspun.
John Watt, William Aytoun, John Menzers, George Stirling, Patrick Pringle, Matthew Witherspun.
16 December John Watt, William Aytoun, John Menzers, George Stirling, Patrick Pringle, Matthew Witherspun.
23 December 1637 John Watt, William Aytoun, Ho.t Sehart?, John Menzers, George Stirling, Patrick Pringle, Matthew Witherspun 3£.
30 december 1637 John Watt, William Aytoun, Ho.t sihart, John Menzers, George Stirling, Matthew Witherspun.
[And so on... always same names, but Matthew Witherspune and Hobert something disappear in 1638]
p. 77: [...] paid to **John Andersone** ... for 3800 shirting/ftuirning nailles at 9 s. 69 d. the hundreth.
Thomas Broun smyth.
Hobert Scott *... guarrell to the warke*.
Item for three daill of caillis? to the maissones ...
p. 78 masons and barrowmen
*Item to **Hobert marstertoun** for 200 daills at 44 £ the hundreth is*
Item to the said Ho.t marstertoun for 19 arbeir plankis at 4 £ 10 s. the peice is
Item for careage of the plankis fra leth to the wark
*Item to **jon scott** conforme to his accompt*
Item to Tho??? ??? and his twa men for ancht days work
Item for mending of ???????? and for ??? and timber to the workmen
Item to James H??? uffice? for arrasting? of the cornes of ??? and ??? the hennentis?
Item to James ??? for wreatting of ??? discharges and ?????????????
Last page: *On the fabrick 1638 £9898.16.6*
**** Nov. 1638 – Nov. 1639 Patrick Baxter**
p. 25: John Watt, William Aytoun, John Menzers, Geroge Stirling, Patirck Pringle
Wrichtis compt
*Item to **Johne Scott** ane oulb 6 £ **johne buchguhaman henrie lauder johne heriot James cryshe**? and **thomas watsone** all ane oulb at 54 s. the peice and **James heriot** 45 s. ??? in all*
p. 26 stones brought from quarry (*guarrell*)
p. 27 [...] *Wrichtis compt*
Item to Johne Scott ane oulb 6 £ Johne buchguhannan henrie lauder johne heriot james cryshe and thomas watsone all ane oulb at 54 s. the peice and johne heriottis fore 45 s. the oulb
p. 28 stones brought from quarry
p. 29 [...] *Wrichtis compt*
Item to Johne Scott 6 £ johne buchguhannan henrie lauder johne heriot james cryshe and thomas watsone all ane oulb at 54 s. the man and jon heriottis ??? at 45 s. the mall?
p. 30 stones brought from quarry
p. 31 John Watt 5 £, William Aytoun 6 £, John Menzers 5 £, Geroge Stirling 3 £, Patrick Pringle 3 £
mason work reduced a lot, from pages and pages to not even half a page
Taskwork? chimney pieces
Wrichtis compt
Item to Johne scott ane oulb 6 £ Johne buchguhannan henrie lauder jon heriot and james cryshe ??? ??? 54 s.
p. 32 stones brought from quarry
p. 33: [...] Taskwork? chimney pieces
Wrichtis compt
Item to Johne scott wrigt 6 £ Johne buchguhannan henrie lauder johne heriot and james cryshe ??? ??? 54 s.
p. 34 stones brought from quarry
p. 35: [...] Taskwork? chimney pieces
Wrichtis compt
Item to johne scott 6 £ jon buchguhannan henrie lauder and jon heriot at 54 s. the peice and james cryshe 5 dayes 45 s.
stones brought from quarry
p. 36: [...] Taskwork? chimney pieces
Wrichtis compt
Item to Johne Scott 5 dayes 5 £ Johne buchguhannan 4 dayes 36 s. jon heriot 5 dayes 45 s. and henrie lauder ane day ??? shillings
stones from the quarry
p. 37: John Watt, William Aytoun, John Menzers, George Stirling, **James guthrie?, James cuthbertsone, harie mudre?** - no other masons anymore
Taskwork? chimney pieces, chimney heads
Wrichtis compt
Item to Jon Scott 6 £ jon buchguhannan jon heriot and henrie lauder 5 £ 2 s. and james cryshe 2 dayes 18 s. ??? in all
stones from the quarry
p. 38 [...] *Wrichtis compt*
Item to Johne scott 6 £ johne buchguhannan johne heriot henrie lauder and james cryshe ??? 54 s.
p. 39 stones brought from quarry
p. 40 [...] *Wrichtis compt*
Item to jon scott 6 £ jon buchguhannan jon heriot henrie lauder and james crushe ??? ane 54 s. ??? mall?
p. 41 [...] *Wrichtis compt*
Item to Jon scott 6 £ Johne buchguhannan jon heriot henrie lauder and james cryshe at 54 s. the peice
p. 42-43-44-45-46-47-48-49-50 same
p. 51: *The compt of the wrichtis and ??? the ellevint day of May 1639 yeiris*
Item to Johne heriot for ancht dayes and ane half at 12 s. ????

*Item to **Geroge heriot** for 5 dayes and ane half at 10 s. ??? day 4 £ 5 s.*
Item for half ane hundreth plencher nailles 4 s.
Item for thrie ???pis to the seat ??? Gairding 3 s.
*Item to **Ho.t ste?msone** 4 £*
Item to the saweris for four draucht treis at 3 s. the draucht ???
Account of the masons: John Watt, William Aytoun, John Menzers, Patrick Pringle
p. 52: Account of the masons
Wrichtis compt
Item to Jon heriot 5 dayes 3 £ and James cryshe 5 days 3 £
stone brought from quarry
account of the maisons
Wrichtis
Item to Jon heriot and james cryshe at thrie pund 12 s. the oulb
p. 53: stones brought from the quarry
Account of the masons
Wrichtis compt
*Item to Johne scott 6 £ jon heriot james cryshe **james jonstoun** and james ??? at 3 £ 6 s. the peice ??? 13 £ 4 s. ??? George Heriot 55 s. ???*
stones brought from the quarry
p. 54: [...] *Wrichtis compt*
*Item to Jon scott 6 £ jon heriot james cryshe james jonstoun and **james riddache**? at 3 £ 12 s. the peice ??? 14 £ 8 s. and George heriot 3 £*
p. 55: Date goes from week to week [...] *Wrichtis compt*
Item to Johne Scott 6 £ jon heriot james cryshe james jonstoun james riddach 14 £ 8 s. and George heriot 3 £
p. 56 same + *Item for 300 flooring naills 36 s. 100 plencher naills 8 s. 2 ?????????*
[...] Item to ??? ??? for 26 draucht wainscot at 3 s. the draucht 3 £ 18 s. and nyne draucht long treis at 4 s. the drau 36 £
p. 57 same + *Item for twa thousand and fyve hundreth fluring nailles at 18 s. the hundreth 15 £*
Item ane doubll heid? ???????
Item given to Jon Scott ??? he gaive ??? at leyt for transporting and careing the grait treis ??? the ??? 5 £ 5 s.
Again to the same guy for carving wainscot and *for sawing of five? doubll treis at 4 s. the draucht being 5 drauchts 20 s.*
p. 58 same + *Item for 700 floring naills at 13 s. 4 d. the hundreth is 4 £ 13 s. 4 d. and ancht hundreth floring naills at 14 s. the hundreth 5 £ 12 s. and thrie pund of butters?*
p. 59 same + *Item for 500 floring naills at 14 s. the hunfreth is 3 £ 18 s. ??? ??? ??? 600 floring naills at 16 s. the hundreth is 4 £ 16 s.*
p. 60 same + *Item 500 floring naills at 14 s. the hundreth is 3 £ 10 s.*
Item ane hundreth ??? plencher naills
Item 100 dure? naills 6 s.
p. 61 same + *Item for 4000 floring naills at 14 s. ????????*
Item for sawing 100 draucht of grait buappald? to ??? ??? 6 £ 13 s. 4 d.
Item for ane ??? of burnwood for melting the lead 6 £ and for careing the same to the wark 18 s.
p. 62 same + *Item ane stand of calk? 10 s. ??????????*
Item to same guy *for ??? draucht of great buappald? at 20 d. the draucht ??? and for sawing seavin daills 21 s.*
p. 63 same + *to the saweris for 10 draucht of doubll treis at 4 s. the draucht 40 s.*
p. 65 [...] *Item cost from johne wimald? ten grait plankis at 10 £ 6 s. the peice*
Item for careing of ??? out of leyt
Item boucht from wam steomson? ane hundreth buappold? at 20 s. the peice
[...] Item the 14 day of February 1639 to mr jon adamsone for 47 buappalt at 20 s. the peice
Item boucht from ane deusman 93 plankis at 4 £ 8 s. the peice
[...] Item to wam ??? for 400 small buapauld? at 20 £ the hundreth
[...] Item to Jon mudrie? and james wylie for 172 wainscot at 7 £ 3 s. 4 d. the peice
[...] Item the 17 day of august 1639 to ane deusman for ane thousand daills at 36 £ ???
people paid for carrying the material from leith
[...] Item the 25 of sept. 1639 bucht from lawrence cowrieson? ane deusman ane hundreth and 20 doubll treis at 24 s. the peice
Item that saime day bucht ??? 70 lang peastis? at 4 s. the peice
600 great buappald?

Summary and comments

Archive National Records of Scotland Doc. Num. GD421/5/3 Folios

Title Heriot's Hospital Treasurer's Accounts 1642-1652 Date: from 1642 to 1652

Contents

Summary and comments

Archive National Records of Scotland Doc. Num. GD421/5/4 Folios

Title Heriot's Hospital Treasurer's Accounts 1652-69 Date: from 1652 to 1669

Contents

Summary and comments

Archive National Records of Scotland Doc. Num. GD421/10/68 Folios

Title	Account of wright work in George Heriot's Chapel and summer house by Thomas Sandilands	Date: from	1683	to	1684

Contents

(outside) *Ane accompt of* ***worke wrought In heriots Wark Chappell and Ane summer house in the easter yeard ffor furnishing timber & nails ther tto***
To Thomas Sandilands
In Anno 1683 & 1684
£ 683
(inside) *Ane Accompt of Wright Work Wrought In Heriots Wark Chappell and att ane Loadge In The Easter Garding from 12 febry In Anno 1683*
Mond 12 febry to the 17 yrof
John Ogstone *5 days 1/2 £ 3.13.04*
John Millar *5 days 1/2 £ 3.13.04*
Thomas Wilsone *2 days 1/2 £ 1.13.04*
Mond 19 febry to the 24 yrof
John Ogstone 5 days 1/2 £ 3.13.04
John Millar 5 days 1/2 £ 3.13.04
Thomas Wilson 6 days £ 4
Mond 26 febry to the 3 of March
John Ogstone 6 days £ 4
John Millar 6 days £ 4
Thomas Wilson 6 days £ 4
Mond 5 March to the 10 yrof
John Ogstone 5 days 1/2 £ 3.13.04
John Millar 5 days 1/2 £ 3.13.04
Thomas Wilson 6 days £ 4
Mond 12 March to the 17 yrof
John Ogstone 4 days 1/2 £ 3
John Millar 6 days £ 4
Thomas Wilson 5 days £ 3.06.08
Mond 19 March to the 24 yrof
John Ogstone 4 days £ 2.13.04
John Millar 6 days £ 4
Thomas Wilson 4 days £ 2.13.04
Mond 26 March to the 31 yrof
John Ogstone 5 days 1/2 £ 3.13.04
John Millar 5 days 1/2 £ 3.13.04
Thomas Wilson 6 days £ 4
Suma is £ 74.13.04
[...]
7 May ***Thomas Chyrmsyd*** and ***William Craih*** **(or Craik?)** are added
14 May ***William Marshall*** is added
21 May ***George Stewartt*** is added (John Millar is lost)
16 July ***William Pottar*** is added
goes on until 6 August: they are always maximum 6, all working at least 4 days
Ittem furnisht 5 scores wenshcoatt planks att 1 lid 2 B yr pice is £ 121.10
Ittem 44 ??? of Nappell £ 15
Ittem 6 double tries £ 6
Ittem 4 greatt Dormants for yr Loft £ 25.12
Ittem 76 Sewdge daels with yr cairage £ 53
Ittem 4 fourtinells wt yr Cairage £ 8
Ittem payed to the sawers conforme to the Accompt for ***sawing of yor Timber wtin The Chappell*** *£ 6.16*
Ittem 7 pound 1/2 of glew at 8 Bre pound £ 3
Ittem 1990 florings £ 9.17
Ittem 290 Double florings £ 2
Ittem 24 single garrons £ 0.12
Ittem 360 polansher naiels £ 1.01
Ittem 1330 dovr naels £ 2.13
Ittem 700 window naiels £ 1.03.04
Suma is £ 288.11
Ane Accompt of Work Wrought at the ffoar ffare of The Laft within the Chappell Anno 1684
from 21 July to 11 August: John Ogstone, William Craih, ***John Scott***
Ittem furnisht of Long wenskcott ??? clifts ane Inch thick at 15 Bre pice is £ 4.1
Ittem 3 clifts inch 1/2 thick 3 the pice £ 9.1
Ittem 3 clifts a inch thick £ 7
Ittem 4 clifts 3/4 aff ane inch thick £ 6
Ittem 5 clifts of short nappell £ 1.16
Ittem 100 blind doors £ 0.03.04
Ittem 60 blind planshers £ 0.01.08
Ittem 60 florings £ 0.05
Ittem 30 florings £ 0.02.05
Ittem 60 planshers £ 0.03

Ittem 60 blind windows £ 0.01.06
tot £ 75.09.04
The 1 page £ 74.13.04
The 2 page £ 88.06.08
The 3 page £ 64
The 4 page £ 92
The 5 page £ 88.11
The 6 page £ 75.09.04
Suma totalis £ 683.00.04
I Thomas Sandilands wright burges of edr grants me to have received from James Kirk & ??? ??? george heriott hospitall the sowme of six hundreth ??? ??? & ane scotts money and that m full payment of the ??? accompt consisting of six ??? and that forr timber wright work and other furnishing furnished be me for the Chappell and ??? ??? ??? ??? discharged the ??? ??? of the accompt as witnes my hand the sixteen day of janry [...]
Thomas Sandilands
John Brown witnes
??? witness

Summary and comments

Archive Royal Commission on the Ancient a | Doc. Num. DP 055037 | Folios

Title: Sections through quadrangle including interior elevations of chapel, dining hall and classrooms. Title: 'GEORGE HERIOT'S HOSPITAL EDINBURGH'. | Date: from 1891 to 1892

Contents

Summary and comments

Archive Private: school archives | Doc. Num. Uncatalogued drawing | Folios

Title: George Heriot's School. Proposed additional class rooms. Plan and sections showing the roof of the East and West ranges. | Date: from 1908 to

Contents

Summary and comments

Archive Private: school archives | Doc. Num. Uncatalogued reports | Folios

Title: Reports on repair works carried out on the roofs of George Heriot Hospital | Date: from 1997 to

Contents

Summary and comments

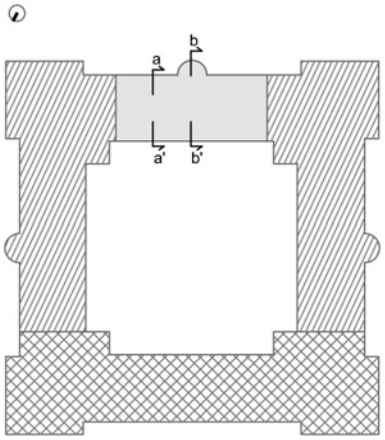
Archive Royal Commission on the Ancient a | Doc. Num. D.8.41.HER.P | Folios

Title: Heriot's Hospital - a short history by D. PRYDE. Extracts from minutes of George Heriot's Trustees. Special articles commemorating the 350th anniversary of the laying of the foundation stone, from the HERIOTER July 1978 | Date: from Undated to

Contents

Heriot's Hospital - a short history by DAVID PRYDE (clerk of works to the governors of George Heriot Trust)
Often the Kingdom of Fife is mentioned as producing men of service to the Hospital: like W. Aytoune.
In July 1627 a ship was sent to Norway to bring over a cargo of timber for the work, and the Foundation Stone was laid on July 1st 1628.
All the roofs of the building are covered with lead. The council provided the material and employed John Bland, plumber, from Newcastle, to theak the hospital with lead, and paid 4/- Scots per stone for casting and working it.
In 1673 "the Kirk of the Citadel of Leith with all its pertinents, glass, timber, and steeple to be made use of in repairing the Hospital Chapel".
Extracts from minutes of George Heriot's Trustees
10 July 1676. Council etc cause Deacon Sandilands proceed to put on and with all possible diligence to putting a roof and Top to the Hospital Steeple according to the draught condesended upon be Sir William Bruce, his advice and finished of rest of the reparations as to the rounds and Roofs of the hospital formerly appointed to.
Special articles commemorating the 350th anniversary of the laying of the foundation stone,
from the HERIOTER July 1978
George Heriot's Hospital and School: a survey of the buildings 1628-1978 - by Brian Lockhart
Timber was brought from Dalkeith, but large timber was imported from Norway in a specially chartered vessel
George Heriot's Hospital, Edinburgh - by Alistair Rowan
Look at "George Heriot's Hospital" 1872 by Dr William Steven
By June 1627 the plan was settled and in July that year the Treasurer had been instructed to "fraucht a ship to bring home joisting and other commodious timber from Norway for their work".
John Watt mason working with Aytoun until 1642 when he dies.
Strange they altered the roofs just few years after doing them: north range, towers, all become flat before 1647.
The chapel ceiling installed in 1787 costed £ 96.16.
Memoirs of a modern monk 1906 - by C. B. Gunn
1627 July 13 - a ship to be sent to Norway to bring home joisting and other timber for the Hospital.
1673 April - The Kirk of the Citadel of Leith, with all its pertinents, glass, timber and steeple, to be made use of for repairing the Hospital Chapel.
George Heriot's Hospital described from an architectural standpoint by Hippolyte J. Blanc architect

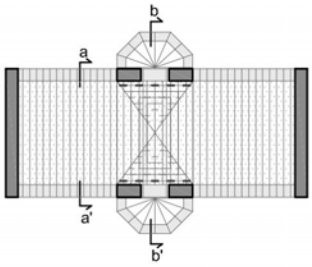
	Wherever the source, there is evidence of a local fashion in the application of features and details of what may be recognised as a special style. That points to the existence of a distinctively Scottish School of Architects, of whom William Wallace was doubtless one.
Summary and comments	



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



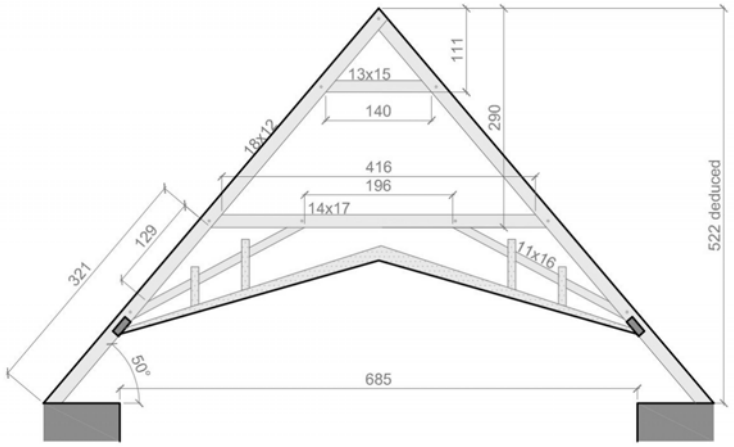
Carpentry marks from west to east:

XXX/II	X/II
XXX/I	X/I
XXX/	X/
XXXIIII	XIIII
XXXIII	XIII
XXXII	XII
XXXI	XI
XXX	X
XX/IIII	VIIII
XX/III	V
XX\II	VIII
XX/I	IIV
XX/	VI
XXIIII	V
XXIII	IIII
XXII	III
XXI	II
XX	I
X/IIII	XXX/III
X/III	

Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

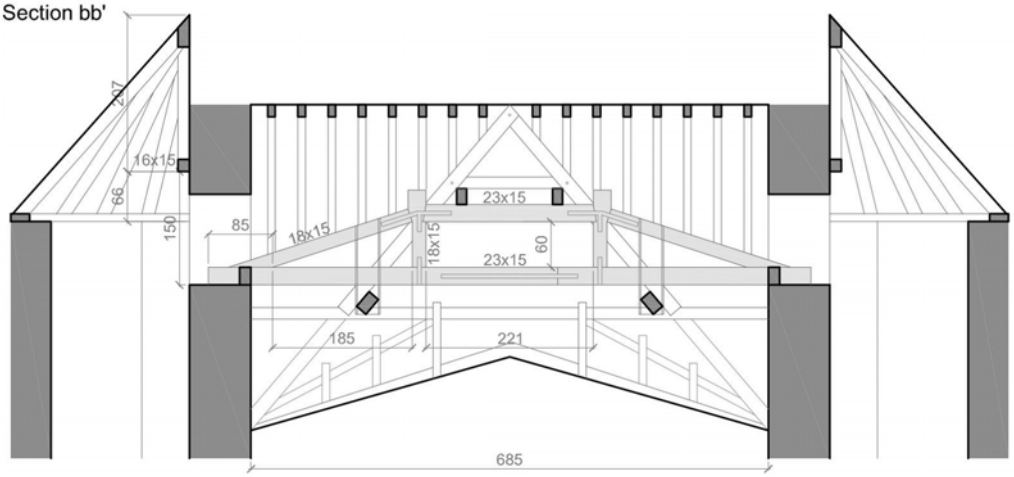
Section aa'



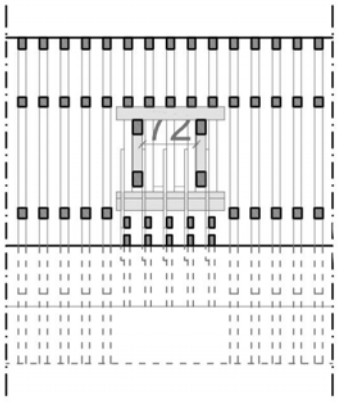
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section cc'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** GEORGE HERIOT'S HOSPITAL SCHOOL | **Roof location** Chapel

Survey date(s) 13/10/2014 | See drawing: GH-C-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.85 | Roof Height [m]: 5.2

Roof Pitch/es [°]: 50 | Roof Length [m]: 18.3

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.37

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1633 To 1637 | Identified by: Estimated

Roof General Description: Two pitch gabled roof with 38 frames, each with two collars and slanted struts under the lower collar. Connection with wall not visible. 2 19C queen trusses in the middle, to support new ceiling, and rafters cut in correspondance to these. Half conical roofs on the sides, joined to the main roof through intersected roofs (whose timbers look of later date).

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 18.5 | B: 12.5 | Or Purlin - H: | B:

Timber elements' Dressing: civil (machine-sawn), rustic (hand-axed) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description: Mostly in sequence, numbered from 1 to 38 from east to west

Signs of reused timbers:

Timber Treated ☐

Other Materials: Metal straps and bolts in 19C truss

Dendrochronology:



Roof Structure link I:\Arch\A



Connection with wall link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: rafter and collar link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: early 19C timber ceiling underneath

Unfavourable conditions:

Accessibility limitations: Connection with wall not visible

Past interventions: Two trusses were inserted in the central part in 1835 to support new timber ceiling. Some sarking and some rafters were replaced recently.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: | link |

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link |

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link |

GLASGOW TRADES HALL

Location: GLASGOW, CITY OF | GLASGOW (GLASGOW, CITY OF)

X coordinate: 259329 Y coordinate: 665183

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 140766

Original Use: Meeting Hall

Current Use: Meeting Hall, Museum

Freestanding ☐ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1791	1794		RYKWERT 1985 & ML T-TH 1/1/7

People involved:

Last Name	First Name	Role	Attributed
ADAM	ROBERT	DESIGNER	☐
CRAIG	JOHN	DESIGNER	☐
BROWN	JOHN	CONTRACTOR, WRIGHT	☐
ADAM 1	JAMES 1	OVERSEER	☐
JAFFRAY	JAMES	DESIGNER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1812			

People involved:

Last Name	First Name	Role	Attributed
HAMILTON	DAVID	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1838			

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1856		"CONSIDERABLE" REPAIRS AND ALTERATIONS TO SECURE THE ROOF	ML T-TH 1/1/12 & TRADES HOUSE BASEMENT C. WILSON'S DRAWINGS

People involved:

Last Name	First Name	Role	Attributed
WILSON	CHARLES	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1887		INTERIORS	RYKWERT 1985

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1955		DOME TIMBER STRUCTURE SUBSTITUTED WITH A NEW STEEL STRUCTURE. GREAT HALL CEILING SUBSTITUTED WITH NEW TIMBER CEILING WITH A SMALLER DOME.	ML WYLIE SHANKS ARCHITECTS COLLECTION, BOX 152

People involved:

Last Name	First Name	Role	Attributed
WYLIE SHANKS ARCHITECT		ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1970	2000	ADDED STEEL BRACKETS TO SOME OF THE ROOF TIMBERS	SUTHERLAND 2000

People involved:

Last Name	First Name	Role	Attributed
ADDISON	JOHN	ENGINEER	☐
CAMPBELL DUFF	GEORGE	ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CRAWFORD G.	1858	☐	A SKETCH OF THE RISE AND PROGRESS OF THE TRADES HOUSE OF GL	

Author	Year	Unpubl.	Title	Pages
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	205
SUTHERLAND F.	2000	☑	"THE TRADES HALL OF GLASGOW." ARCHAEOLOGICAL DESK STUDY F CONSERVATION MANAGEMENT PLAN BY BMP ARCHITECTS	
WILLIAMSON E. & RICHES A.	1990	☐	THE BUILDINGS OF SCOTLAND COLLECTION: GLASGOW	

ARCHIVAL REFERENCES

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/1/7	

Title: Trades House: docquetted minute book and Collectors' Accounts, Feb 1787 - 17 May 1798

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/34/4	

Title: New buildings proposed in 1883 & report of the building committee in 1878

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/34/1	

Title: Estimates for building and plasterwork

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 9/4/2	

Title: Incorporation of Wrights: membership roll, 1731 - 1811

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 9/4/3	

Title: Incorporation of Wrights: membership roll, 1811 - 1882

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/1/12	

Title: Trades House: docquetted minute book and Collectors' Accounts, 13 Oct 1853 – 8 Sep 1865

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/17/1	

Title: Copies of Trades House Accounts in MSS, 1711 – 1713, 1720 – 1817 and abstracts of same

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 5/19/15	

Title: James Jaffray designs for the Trades Hall 8th June 1791

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 5/19/16	

Title: Minutes of Building Committee 26th January 1792

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 5/19/17	

Title: Minutes of Building Committee 10th March 1792

Archive	Doc.Num.	Folios
Mitchell Library	Wylie Shanks Architects Collection, Box 152, Drawings T6	5, 6, 7

Title: Survey of the Trades House of Glasgow and alterations by Wylie Shanks Architects

Archive	Doc.Num.	Folios
Private: Trades Hall (basement)	1/899	2, 3, 4, 5

Title: Survey and Alterations to Glasgow Trades Hall roof structure by the Architect Charles Wilson in 1856: plan and sections

Archive	Doc.Num.	Folios
Soane Museum London	Adam volume 48	2

Title: Glasgow Trades Hall section front to back by Robert Adam

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/34/3	

Title: The ceiling of the great hall in Glasgow Trades Hall

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/97/3	

Title: Plans and section of Glasgow Trades Hall by John Laird

Archive	Doc.Num.	Folios
Mitchell Library	T-TH 1/97/2	

Title: New design for Glasgow Trades Hall proposed by architects James Salmon and Son

Suggestions for further research

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive: Mitchell Library | Doc. Num.: T-TH 1/17/1 | Folios:
Title: Copies of Trades House Accounts in MSS, 1711 – 1713, 1720 – 1817 and abstracts of same | Date: from 1711 to 1817
Contents:
Summary and comments:

Archive: Mitchell Library | Doc. Num.: T-TH 9/4/2 | Folios:
Title: Incorporation of Wrights: membership roll, 1731 - 1811 | Date: from 1731 to 1811
Contents:
Summary and comments:

Archive: Mitchell Library | Doc. Num.: T-TH 1/1/7 | Folios:
Title: Trades House: docquetted minute book and Collectors' Accounts, Feb 1787 - 17 May 1798 | Date: from 1787 to 1798
Contents:
26 January 1791
...it will be much better suited to the dignity of the house and incorporations to have a hall of their own...
21 March 1791: committee appointed to find land to build the hall
18 May 1791: many lands proposed, Glassford street is the preferred one – 80x87 feet. Architect James Jaffray was appointed to make the plans. The incorporations wants to put shops at ground floor to get some money from them.
8 June 1791: Jaffray does 2 plans
21 June 1791: masons suggest *to have a still greater choice and variety of plans*
22 June 1791: after consultation with Robert Smith, Daniel Wardrop and James Burns, architect Adam is proposed
28 June 1791: Adam returned to London so plans are asked to architect John Craig
18 July 1791: Adam came on the 15th, he did plans, and John Craig too
23 Januray: the estimates by Wardrop (mason), Morison & Burns (wrights), Lillie (plasterer), W Sangs (smith) are approved
24 January 1792: Adam proposes 6 shops instead of 4 (Jaffray). The total cost is 7000£ instead of 4000£ (Jaffray)
6 February 1792: they have problems with money so decide to ask for other estimates
16 February 1792: they ask Adam to modify the building design so that it costs less
20 March 1792: they want to write to William Adam *or any relative papers concerning the hall which may have been in his brothers possession at his death, and to know if it is agreeable to him to lodge an estimate for the work*
9 May 1792: estimate from William Purdie wright and John Brown wright. They prefer the latter, which becomes contractor for the hall, for a total of ca. 5000£.
11 May 1792: *the general committee resolve that the building shall immediately begin under the direction of the aforesaid James Adam, and his brother William Adam*
4 October 1793: the deafening of the floors of the hall and the sounding boards of the dome (they put a bell inside!) had been omitted in Brown's estimate
28 October 1793: so house has to pay for the extra works
20 March 1794: the hall is almost finished, so they want to make an insurance against fire
22 April 1794: furniture
24 June 1794: Adam suggests an external stair to go up to the hall from the street, but the magistrate doesn't allow it
21 August 1794: obtained an access to the grounds on the back of the hall
9 October 1794: delay in building the *retiring rooms*
18 November 1794: they want to let the hall for balls/dinners/exhibitions
22 December 1794: it's finished!
15 September 1795: Brown asked for money for extra work but his requests were only partially accepted
30 September 1795: the retiring rooms are finished
7 December 1795: coat of arms on façade is not well done
Summary and comments:

Archive: Mitchell Library | Doc. Num.: T-TH 1/34/1 | Folios:
Title: Estimates for building and plasterwork | Date: from 1791 to 1792
Contents:
Mason David Wardrop 1791
...all joisting to be laid by the wright as the work requires in its going forward and found by him likewise...
Wrights Morison & Burns 1792
...we have measured and calculated the whole of the wright, glazier and slate work for the trades hall […] *2820£*
Plaster estimates by William Meikle, Thomas Lillie, Robert Buchan
Summary and comments:

Archive: Mitchell Library | Doc. Num.: T-TH 5/19/15 | Folios:
Title: James Jaffray designs for the Trades Hall 8th June 1791 | Date: from 1791 to

Contents

Summary and comments

Archive: Soane Museum London | Doc. Num.: Adam volume 48 | Folios: 2

Title: Glasgow Trades Hall section front to back by Robert Adam | Date: from 1791 to

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 5/19/17 | Folios:

Title: Minutes of Building Committee 10th March 1792 | Date: from 1792 to

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 5/19/16 | Folios:

Title: Minutes of Building Committee 26th January 1792 | Date: from 1792 to

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 9/4/3 | Folios:

Title: Incorporation of Wrights: membership roll, 1811 - 1882 | Date: from 1811 to 1882

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 1/1/12 | Folios:

Title: Trades House: docquetted minute book and Collectors' Accounts, 13 Oct 1853 – 8 Sep 1865 | Date: from 1853 to 1865

Contents

Summary and comments

Archive: Private: Trades Hall (basement) | Doc. Num.: 1/899 | Folios: 2, 3, 4, 5

Title: Survey and Alterations to Glasgow Trades Hall roof structure by the Architect Charles Wilson in 1856: plan and sections | Date: from 1856 to

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 1/97/2 | Folios:

Title: New design for Glasgow Trades Hall proposed by architects James Salmon and Son | Date: from 1877 to

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 1/34/4 | Folios:

Title: New buildings proposed in 1883 & report of the building committee in 1878 | Date: from 1878 to 1883

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 1/97/3 | Folios:

Title: Plans and section of Glasgow Trades Hall by John Laird | Date: from 1931 to

Contents

Summary and comments

Archive: Mitchell Library | Doc. Num.: Wylie Shanks Architects Collection, | Folios: 5, 6, 7

Title: Survey of the Trades House of Glasgow and alterations by Wylie Shanks Architects | Date: from 1955 to

Contents

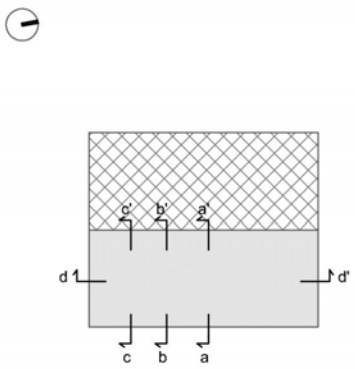
Summary and comments

Archive: Mitchell Library | Doc. Num.: T-TH 1/34/3 | Folios:

Title: The ceiling of the great hall in Glasgow Trades Hall | Date: from Undated to

Contents

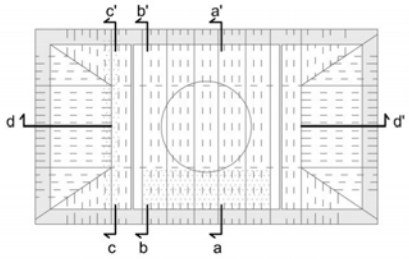
Summary and comments



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

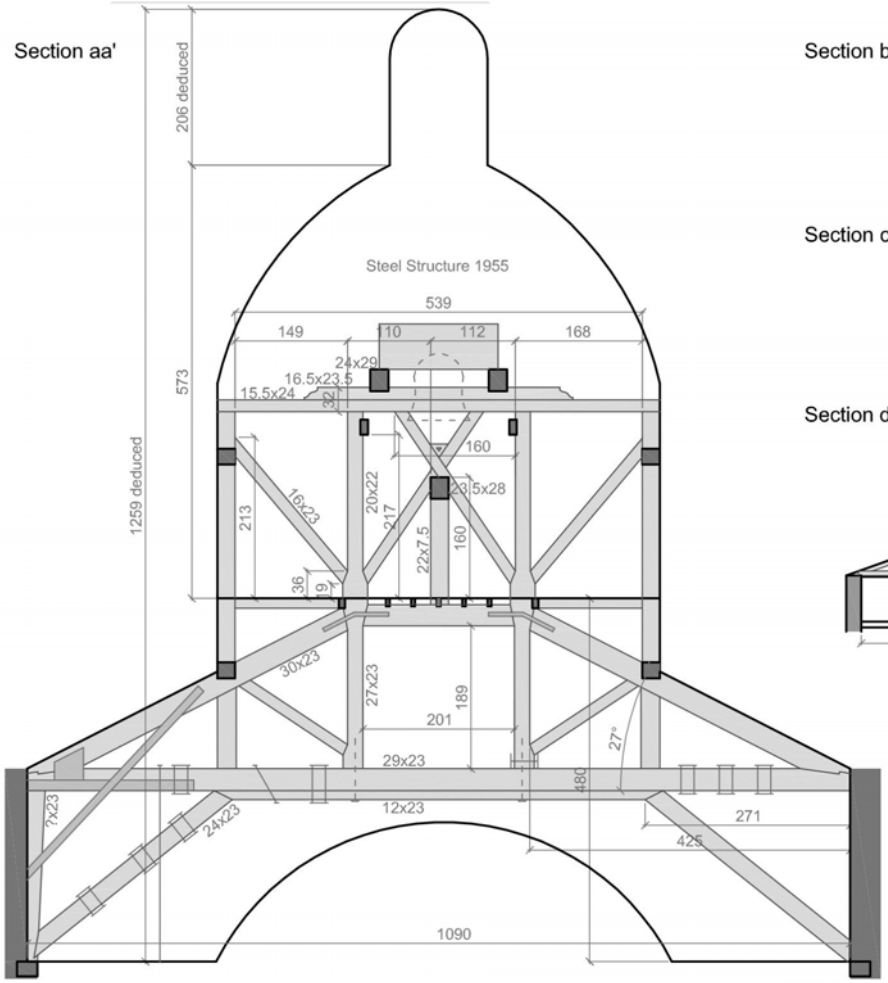
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



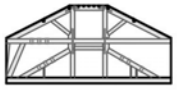
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

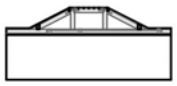
Section aa'



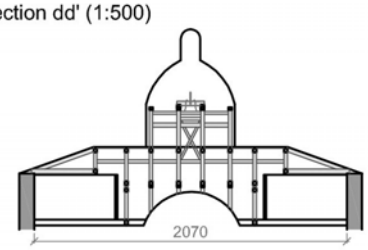
Section bb' (1:500)



Section cc' (1:500)



Section dd' (1:500)



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** GLASGOW TRADES HALL | **Roof location** Great hall

Survey date(s) 13/06/2014 | 09/12/2014 | 25/08/2015 | See drawing: GTH-GH-1

Roof Geometry: Dome, Flat, Hipped

Roof Max Span [m]: 10.9 | Roof Height [m]: 12.59

Roof Pitch/es [°]: 27 | Roof Length [m]: 20.7

Type of Primary Structure: 2D framing

Truss ☑ QUEEN-POST

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, purlins, sa | Plane: horizontal, roof plane, vertical

Sarking boards: width [cm]: | thickness [cm]:

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1791 To 1794 | Identified by: Estimated

Roof General Description:

Hipped platform roof with 6 queen trusses supporting a small dome on top. 4 middle trusses are interrupted in the lower part by a small cupola. Trusses have tie-beam, 2 posts partly encased in the lateral walls, and an arch formed by 2 struts and a horizontal element; this arch supports an upper queen truss. Above this is the dome (now supported by a 1950s steel structure) and bell frame (original timbers). The timbers have big scantlings but some are roughly hand axed, others are more finely dressed with a hand saw. There are some unusual carpentry marks.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular, Square

Rafter Scantling [cm] H: 30 | B: 23 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: joggle, mortice and tenon

Fasteners Types: Metal bolt, Metal strap

Joints description:

All mortice and tenon. Fasteners not visible. Metal straps in the upper "arch" and along the posts. Posts have joggles at the top and bottom.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: arabic numerals, lettering, runic marks, small chiseled roman numerals

Carpentry Marks Description:

AM on a strut in the lower part. WC on a horizontal element in the dome. 8BS+other numbers engraved on many elements. Another engraving repeated: <c>. Also two small drawings, one in the lower part, one in the dome.

Signs of reused timbers:

Some redundant joints but probably connected with removed elements. Strange carpentry marks - maybe ship timbers?

Timber Treated ☑ white spray where lateral rooms are

Other Materials:

Dendrochronology:



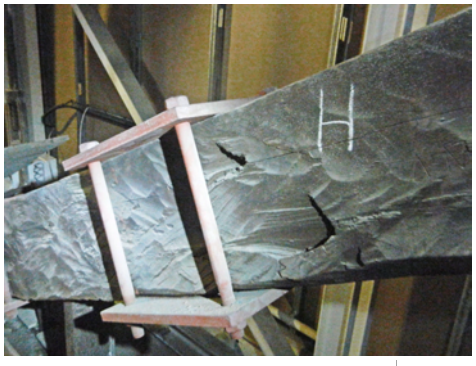
Roof structure: lower part | link I:\Arch\A



Roof structure: upper part | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Carpentry marks and joints | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor design

Accessibility limitations

Past interventions: Works in 1850s: metal straps and few timbers added. Works in 1950s: sarking and slating redone, façade on glassford st partly redone. Works in 1991: steel brackets installed on many upper tie-beams and struts, steel rods installed to link the rafters and the lower posts on glassford st side, checks filled with resin, opening connections filled with timber wedges.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☐

Humidity stains on sarking and common rafters



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	transversal opening	Intervened on	Primary
Unit Damage			
Element Damage	Cracks	Unknown	Collateral
Connection Damage	Disconnection	Unknown	Collateral



Past interventions | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient joints, inefficient overall arrangement
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: cracking | link | I:\Arch\A

Description of visible damage: Some timbers are cracked and many joints are opening: some have been "closed" with timber wedges, others not. The transversal opening of the trusses, that caused these problems and that the 80s and 90s works tried to counteract, could be still ongoing.



Damage: disconnection | link | I:\Arch\A

Other Notes: Robert Adam was the architect (even though J. Craig and J. Geoffrey made designs as well), but then he died and his design was changed and built probably not by his brother James, who also died before the works were finished, but by Paterson (this is F. Sutherland's opinion). He shrinked the whole building and the dome in particular. For sure John Brown, wright, was the contractor. He might have designed the roof structure, since it works better than the one drawn by

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui

GLASGOW TRON CHURCH

Location: GLASGOW, CITY OF | GLASGOW (GLASGOW, CITY OF)
X coordinate: 259526 Y coordinate: 664880
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 139510

Original Use: Religious
Current Use: Theatre

Freestanding ☐ N. of floors above ground level: 2 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1484			BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
RECONSTRUCTION	1592			BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1630	1636	STEEPLE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
DAMAGE, RECONSTRUCTION	1793	1794	CHURCH REBUILT AFTER FIRE (ONLY STEEPLE REMAINED), SET BACK AND INDEPENDENT OF THE STEEPLE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM 1	JAMES 1	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1855		ARCHES ON GROUND LEVEL OF TOWER INSERTED	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1899	1900	BAROQUE SCREEN WALL AND GATEWAY ADDED TO THE EAST WALL FORMING A COURTYARD	HS

People involved:

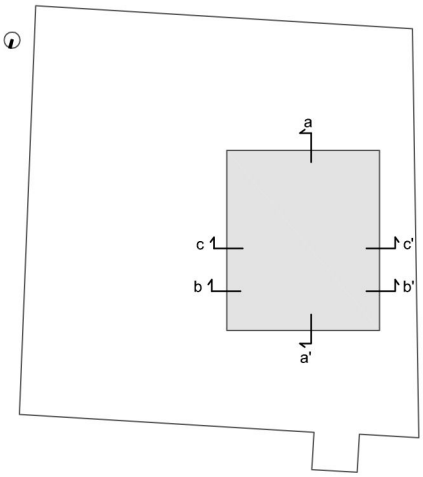
Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1979	1981	CONVERTED INTO A THEATRE - MOST OF THE INTERIOR WAS RECAST EXCEPT FOR THE PLASTER IN THE DOME (SAYS HS)	BUILDINGS OF SCOTLAND COLLECTION

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	205
SUMMERSON S. J. N.	1963	☐	THE CLASSICAL LANGUAGE OF ARCHITECTURE	511
WILLIAMSON E. & RICHES A.	1990	☐	THE BUILDINGS OF SCOTLAND COLLECTION: GLASGOW	

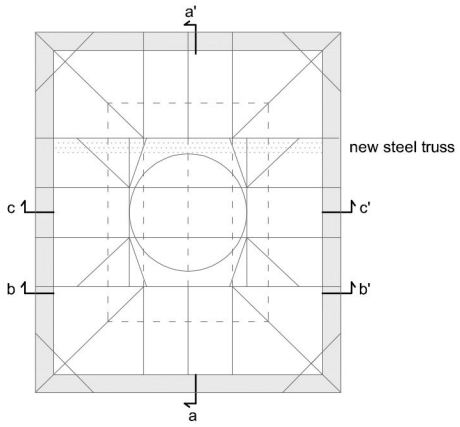
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

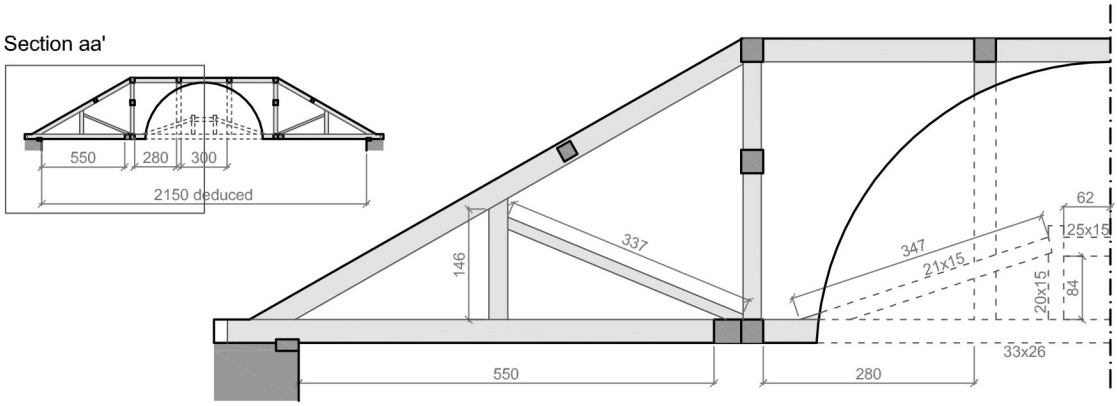
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

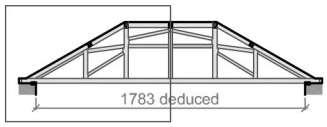
Section aa'



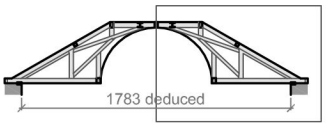
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

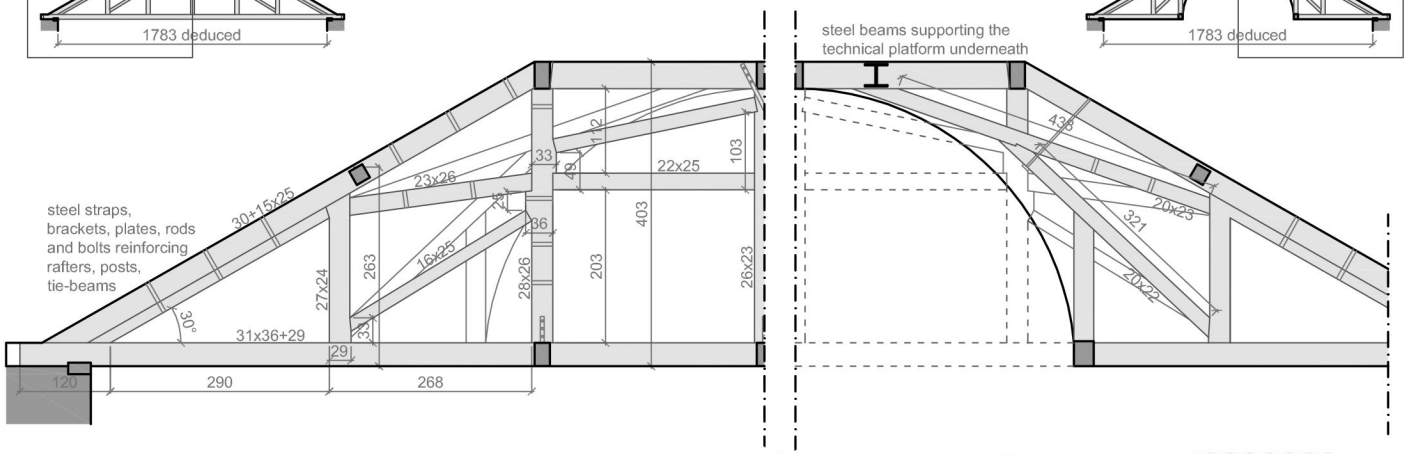
Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section cc'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** GLASGOW TRON CHURCH | **Roof location** Main auditorium

Survey date(s) 14/08/2015 | See drawing: GTC-MA-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 17.8 | Roof Height [m]: 4

Roof Pitch/es [°]: 30 | Roof Length [m]: 21.5

Type of Primary Structure: 3D framing

Truss ☑ OTHER

Frame ☐

Average Distance in between Primary Structure [m]: 2.9

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Dragon tie, Tie-beam, Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1793 To 1794 Identified by: Estimated

Roof General Description:

Hipped platform roof with internal plaster dome. 4 trusses in the transversal direction, with five posts each. They have a truss inside another truss: short principals reach half the height and form an arch system with horizontal beams, inside the bigger truss. Two shorter trusses in the longitudinal direction, supporting the transversal trusses. Dragon beams and ties are used in the corners. The rest of the rafters rest on wall-plates. Timbers with big scantlings, partly hand axed and partly hand sawn. There are some unusual carpentry marks.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 30 B: 25 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: joggle, mortice and tenon, notch

Fasteners Types: Metal strap

Joints description:

All mortice and tenon with no fasteners, except for metal straps between posts and lower and upper beams and rafters. Posts have joggles or notches for the struts.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: runic marks, small chiseled roman numerals

Carpentry Marks Description:

Only a few visible.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: post and struts/beams link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: Original dome plaster ceiling underneath.

Unfavourablec onditions:

Accessibility limitations:

Past interventions: Steel straps, brackets, plates, rods and bolts reinforcing rafters, posts, tie-beams. Some sarking and common rafters replaced. New steel truss on south side of plaster dome. Timber wedges inserted in opened joints. Steel beams supporting technical theatre platform underneath. Timber replacements of some tie-beams' ends.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks	Intervened on	
Connection Damage	Disconnection	Intervened on	



Damage: purlin cracking | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☑ increase of dead loads
- Extreme actions ☐
- Other ☐



Damage: post cracking | link | I:\Arch\A

Description of visible damage: Posts, rafters and purlins have cracks. Some joints have opened. All intervenend on, but not sure if effectively (some new cracks have opened in the plaster ceiling).



Damage: joint opening | link | I:\Arch\A

Other Notes:

Attachments:

HADDO HOUSE

Location	ABERDEENSHIRE	METHLICK	
X coordinate	386831	Y coordinate	834750
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PUBLIC		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	19842
Original Use	Residential		
Current Use	Museum		

Freestanding ☑ N. of floors above ground level 3 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
DESIGN	1728			BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1732	1736		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BAXTER	JOHN THE ELDER	CONTRACTOR, MASON	☐
JOHNSTON	JOHN	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1822		STAIRCASE FROM FIRST TO SECOND FLOOR	CANMORE

People involved:

Last Name	First Name	Role	Attributed
SIMPSON	ARCHIBALD	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1843		KITCHEN COURT	CANMORE

People involved:

Last Name	First Name	Role	Attributed
SMITH	J & W	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1878	1880	CHAPEL	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1879	1881	INTERIORS - MAYBE ROOF STRUCTURE AS WELL (SAYS IAN DAVIDSON)	CANMORE

People involved:

Last Name	First Name	Role	Attributed
WARDROP & REID		ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1930	1940	FIRE IN SOUTH WING	IAN DAVIDSON

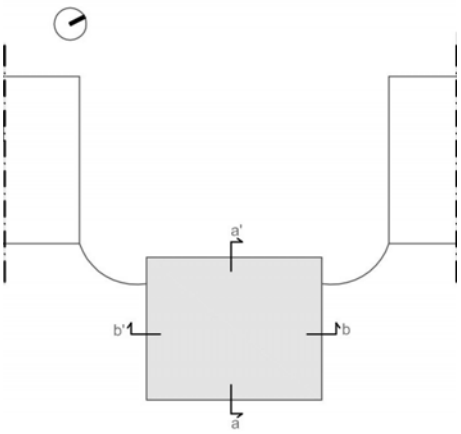
People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
WALKER D. & WOODWORTH M.	2015	☐	THE BUILDINGS OF SCOTLAND COLLECTION: ABERDEENSHIRE: NORT MORAY	
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 54-56

Author	Year	Unpubl.	Title	Pages
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	54-56

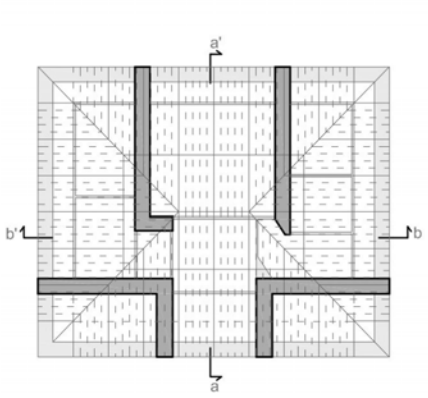
Suggestions for further research	NRS: accounts from 1739 to 1765 (GD33/65/112/4) and accounts from 1772 to 1811 (GD33/65/112/5) Papers held privately by the family



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

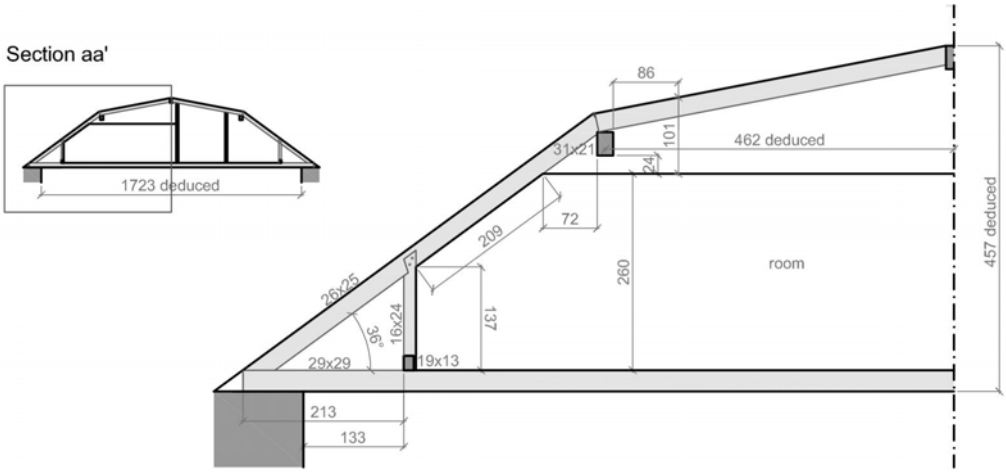
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

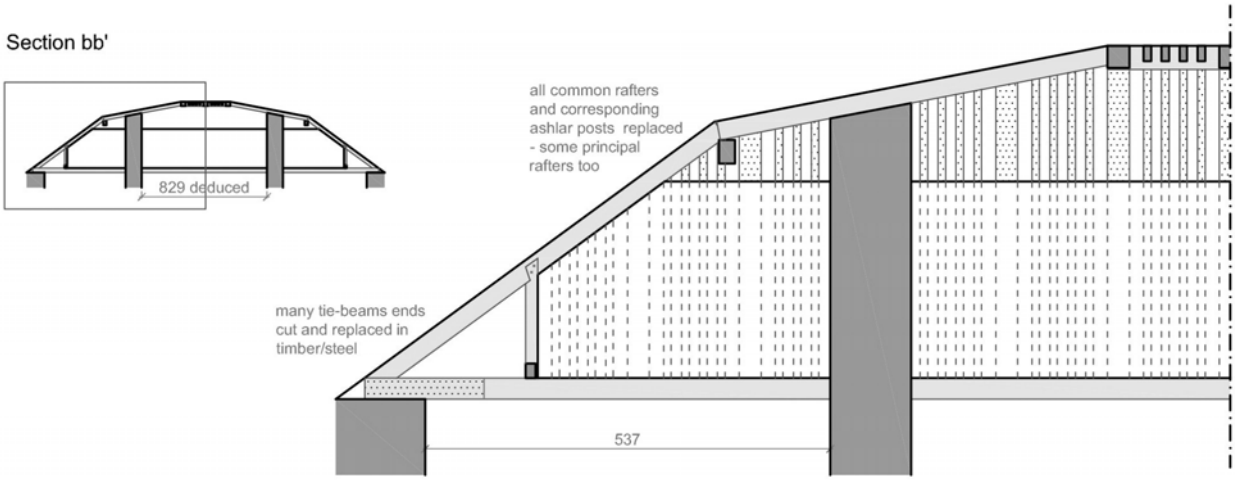
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** HADDO HOUSE | **Roof location** Main block

Survey date(s) 06/08/2015 | See drawing: HDH-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 8.29 | Roof Height [m]: 4.57

Roof Pitch/es [°]: 36 | Roof Length [m]: 17.23

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]: 4.62

Type of Secondary Structure: common rafters, sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Dragon tie

Connection with gables: purlins

Roof Construction Period: From 1732 To 1736 Identified by: Estimated

Roof General Description: Hipped platform roof supported by transversal walls and purlins. Frames divided into primary and secondary ones (1 primary every 4 secondary), with different scantlings. Little remains of original timbers especially at wall-head level, where most of them have been replaced with prostheses. Rafters and tie-beams connected with tension ashlar posts. Dragon beams and ties in the corners.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular, Square

Rafter Scantling [cm] H: 26 B: 25 Or Purlin - H: 31 B 21

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail

Joints description:

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Joints: principal rafter and strut link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourablec onditions

Accessibility limitations: Most of the structure not visible because of plastering

Past interventions: Wallhead raised. All common rafters and their ashlar posts replaced. Sarking replaced. Some tie-beams replaced in timber and steel.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link | I:\Arch\A

Description of visible damage

link | I:\Arch\A

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link | I:\Arch\A

HOPETOUN HOUSE

Location: WEST LOTHIAN | ABERCORN (WEST LOTHIAN)

X coordinate: 308856 Y coordinate: 679016

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 49127

Original Use: Residential

Current Use: Meeting Hall, Museum, Residential

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1699	1701	ONY W FAÇADE AND SMALL ROOMS OF THE CENTRE BLOCK OF THE HOUSE SURVIVE	CANMORE

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT	☐
BACHOP	TOBIAS	STONE WORKER	☐
EIZAT	ALEXANDER	CARVER, WRIGHT	☐
EIZAT	WILLIAM	WRIGHT	☐
EDWARD	ALEXANDER	DESIGNER	☐
WARRANDER	THOMAS		☐
MORGAN	WILLIAM	CARVER	☐
TIDEMAN	PHILIP	PAINTER	☐
HOPE	LADY MARGARET	COMMISSIONERPATRON	☐
NORIE	JAMES	PAINTER	☑
FORSTER	JOHN	GLAZIER, PLUMBER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION, LANDSCAPE	1721	1748	CENTRE BLOCK WIDENED, COLONNADES AND PAVILLIONS ADDED	HS

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT, CONTRACTOR	☐
ADAM	ROBERT	ARCHITECT, CONTRACTOR	☐
ADAM	JOHN	ARCHITECT, CONTRACTOR	☐
HOPE	CHARLES 1ST EARL O	COMMISSIONERPATRON	☐
DAWSON	JOHN	PLASTERER	☐
CLAYTON	THOMAS	PLASTERER	☑

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1893		MAIN GATES AND LODGE	CANMORE

People involved:

Last Name	First Name	Role	Attributed
ROWAND ANDERSON	ROBERT	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2000		DATE NOT SURE	JOHN ADDISON

People involved:

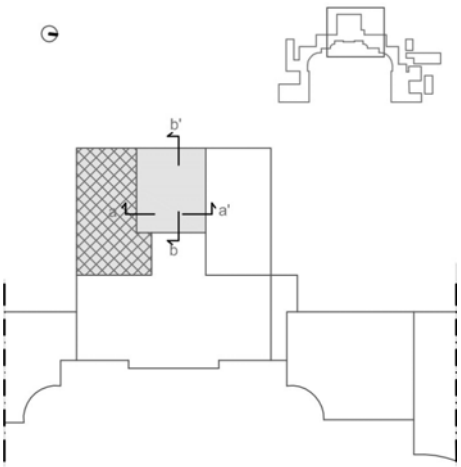
Last Name	First Name	Role	Attributed
ADDISON	JOHN	ENGINEER	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	80-81

Author	Year	Unpubl.	Title	Pages
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	120
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	86
LOWREY J.	2012	☐	A PROSPECT OF ANTIQUITY AND BRITANNIA ON EDGE: LANDSCAPE D THE WORK OF SIR WILLIAM BRUCE AND ALEXANDER EDWARD	ARCHITECTURAL HERITAGE, VOL. 23
MACAULAY J.	2009	☐	SIR WILLIAM BRUCE'S HOPETOUN HOUSE	ARCHITECTURAL HERITAGE, VOL. 20
MACKECHNIE A.	2012	☐	INTRODUCTION. SIR WILLIAM BRUCE AND ARCHITECTURE IN EARLY I SCOTLAND	ARCHITECTURAL HERITAGE, VOL. 23
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	12
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	210
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	17
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 14-21

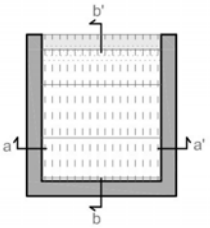
Suggestions for further research	Private archives at Hopetoun house (consultation fee) Wing roof is original even though it was not surveyed because of lack of time



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

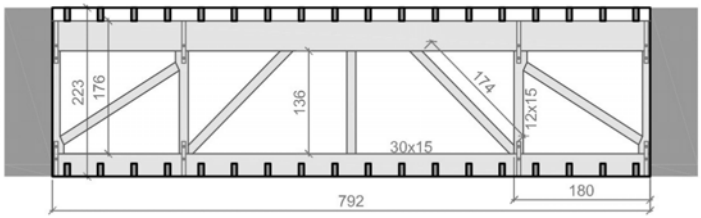
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

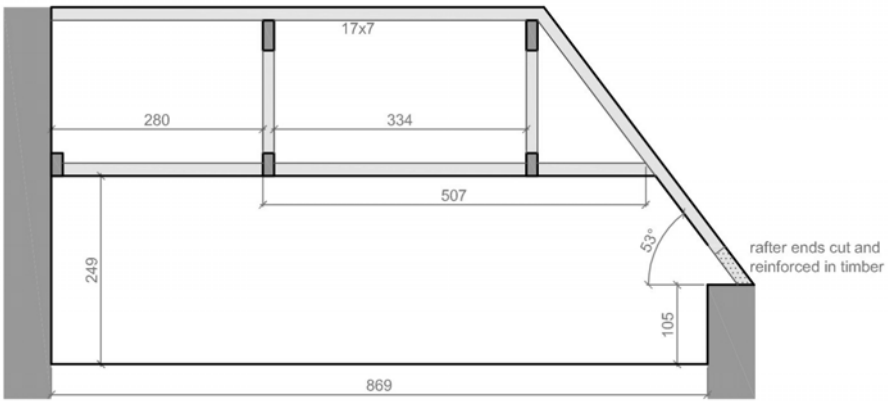
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A

INITIAL SURVEY | **Building name** HOPETOUN HOUSE | **Roof location** 1: central block

Survey date(s) 21/08/2015 | See drawing: HPH-CB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 7.9 | Roof Height [m]: 2.2

Roof Pitch/es [°]: 53 | Roof Length [m]: 8.7

Type of Primary Structure: 2D framing

Truss ☑ | Frame ☐

Average Distance in between Primary Structure [m]: 3.34

Type of Secondary Structure: common rafters, sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables: purlins

Roof Construction Period: From 1721 To 1748 | Identified by: Estimated

Roof General Description: A hipped platform roof supported by transversal walls. Only central and South part fully visible. South part seems to have been almost fully replaced in 19C. Central part is supported by 2 trusses composed of an upper and a lower purlin and posts and slanted struts in between them, supporting common rafters and sarking. The two horizontal beams are full logs, with big scanltings. The posts and struts are smaller, porbably half logs or quarters of logs. They are all hand sawn. No numbering is visible.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: 30 | B 15

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: joggle, mortice and tenon

Fasteners Types: Metal strap

Joints description:

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description: Not visible

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: post and beam/strut | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Sarking and some horizontal common rafters replaced. Common rafter ends all cut and replaced in timber.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

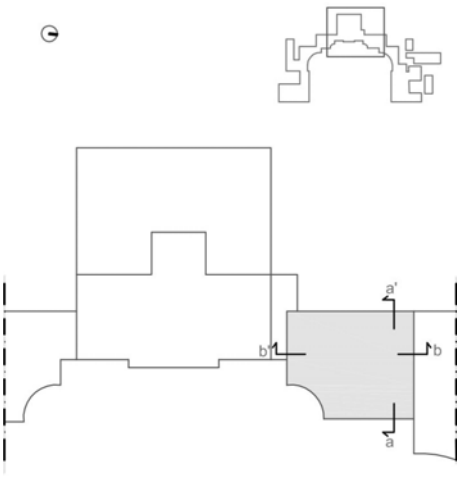
Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

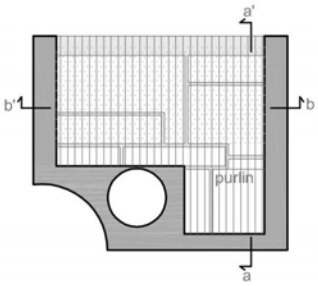
Attachments | link



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



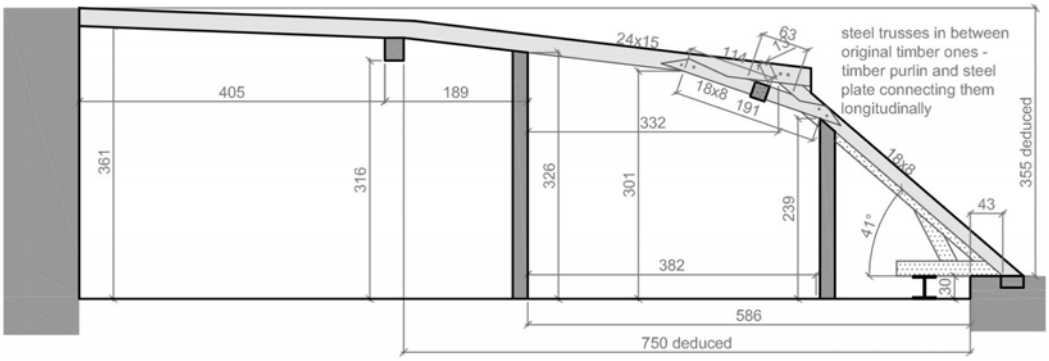
Carpentry marks from north to south:

not visible	XIX
IIII	XX
Λ	IIX
IIIIΛ	X
IX	ΛIX
I	II
IIΛ	IIIX
X	IIXX
III	IIIXX
IΛ	ΛXX
not visible	IIIΛ
XXI	IIΛX
IIIΛXX	IΛXX
IIIIXX	not visible

Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

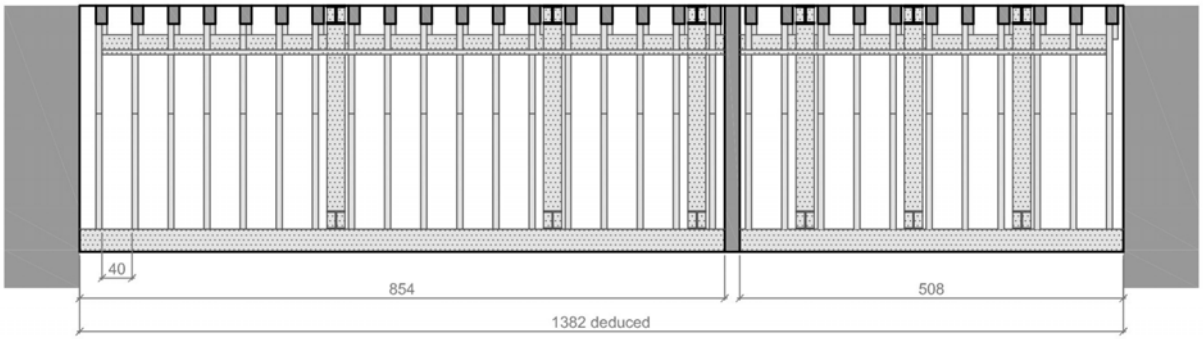
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A

INITIAL SURVEY | **Building name** HOPETOUN HOUSE | **Roof location** 2: N range

Survey date(s) 21/08/2015 | See drawing: HPH-N-1

Roof Geometry: Flat, Mansard, Shed

Roof Max Span [m]: 7.5 | Roof Height [m]: 3.55

Roof Pitch/es [°]: 41 | Roof Length [m]: 13.8

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]: 0.38

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: rafters

Roof Construction Period: From 1721 To 1748 Identified by: Estimated

Roof General Description: Monopitch roof supported by a spine wall and purlins, on which sit 29 rafters whose pitch decreases (from almost flat to 41 degrees). In the junction between the rafters with higher and lower pitch there is a short strut tying the two together. A steel frame has been recently added to support the rafters at wall-head level. The timbers are half logs, hand axed and then hadn sawn in two. They are numbered with big sawn roman numerals.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 24 B: 15 Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Mortice and tenon with two timber pegs not flush between rafter and rafter. Dovetail notched lapped with two metal nails between strut and rafters.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Not in sequence

Signs of reused timbers

Timber Treated ☐

Other Materials: Steel beams and rods

Dendrochronology



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Roof structure link I:\Arch\A



Joints: rafters and strut link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Flat part of roof structure not visible

Past interventions: Timber reinforcing rafter ends. Steel trusses in between the original timber ones, connecting all of them with a timber purlin and steel plates.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:		link	
Roof Damage						
Unit Damage						
Element Damage						
Connection Damage						

Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments | link

KELBURN CASTLE

Location: NORTH AYRSHIRE | LARGS
X coordinate: 221708 | Y coordinate: 656701
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A | Rcahms ID: 41169

Original Use: Residential
Current Use: Residential

Freestanding: ☑ | N. of floors above ground level: 4 | Location link: I:\Arch\AD | Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1175	1225		BENJAMIN TINDALL ARCHITECT
People involved:				
CONSTRUCTION	1500	1550	EAST PART OF TOWER HOUSE - A CHARTER OF 1556 REFERES TO IT	BUILDINGS OF SCOTLAND COLLECTION
People involved:				
ADDITION	1581		EXTENSION TO FORM Z PLAN - DATE ON SOUTH WALL ABOVE CUSPED OF TOWER HOUSE	BUILDINGS OF SCOTLAND COLLECTION
People involved:				
ADDITION	1692	1703	WEST END OF NORTH RANGE, REPLACING AN EARLIER BUILDING	BUILDINGS OF SCOTLAND COLLECTION

People involved:	Last Name	First Name	Role	Attributed
	CALDWELL	THOMAS	CONTRACTOR, MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1722		CENTRALO AND EAST PART OF NORTH RANGE	BUILDINGS OF SCOTLAND COLLECTION

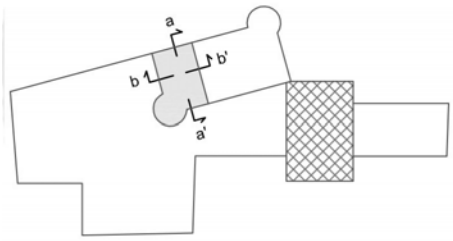
People involved:	Last Name	First Name	Role	Attributed
	BOYLE	DAVID 1ST EARL OF	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1879	1885	NORTH EAST WING	BUILDINGS OF SCOTLAND COLLECTION
People involved:				

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CLOSE R.	2012	☐	THE BUILDINGS OF SCOTLAND COLLECTION: AYRSHIRE AND ARRAN	
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	24-31

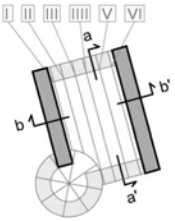
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

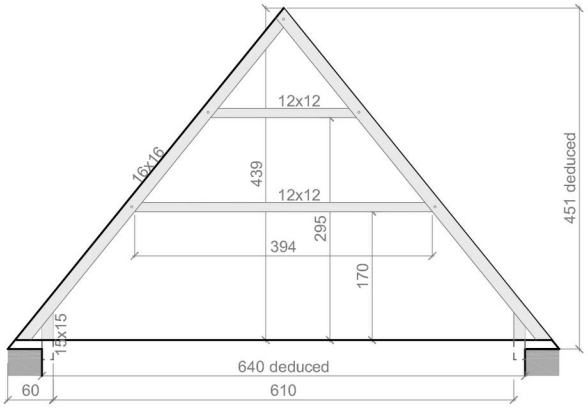
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

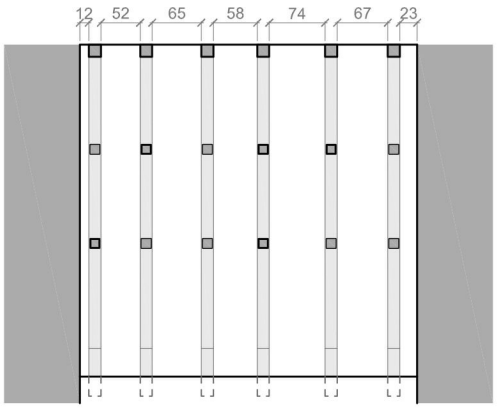
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** KELBURN CASTLE | **Roof location** 1: Old tower house to S

Survey date(s) 09/07/2015 | See drawing: KC-S-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.4 | Roof Height [m]: 4.5

Roof Pitch/es [°]: 51 | Roof Length [m]: 4.5

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.63

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 2.5

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1581 To | Identified by: Estimated

Roof General Description: Only part of the towerhouse gabled roof is accessible. It's composed of 6 frames with two collars and rafter feet. Timbers are very roughly squared, some are not even straight. There are saw marks as well, though. Some of the original timber pegs securing the slates to the sarking are still in place.

Roofing Material: slate

Roofing Material Fixing: Metal nails, Timber Pegs

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 16 B: 16 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush

Wood Species: the structure seems to be oak, the sarking pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Numbered from I to VI, in sequence (from east to west)

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Dressing and carpentry marks | link I:\Arch\A



Joints: rafter apex | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance

Accessibility limitations: Connection with wall not visible

Past interventions: Sarking on north side replaced (in 19C?).



Fungi attack in south-east corner | link I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☐

Serpula lacrimans attacking south-east corner (rafters and sarking) - active. There is water ingress in this area of the roof and an open water tank is in the roof space.

	Damage Type:	Damage Status:	Damage Role:	link
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

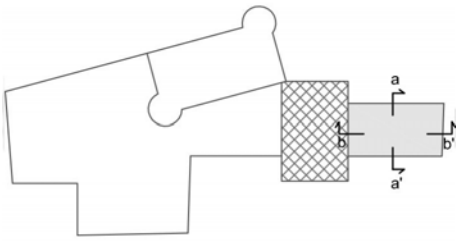
Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes: Repair works are undergoing (July 2015)

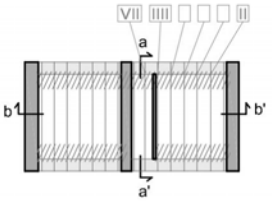
Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

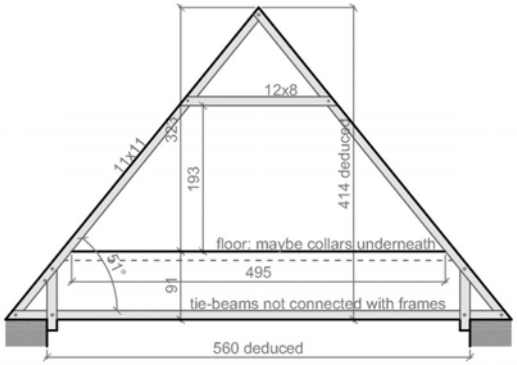
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

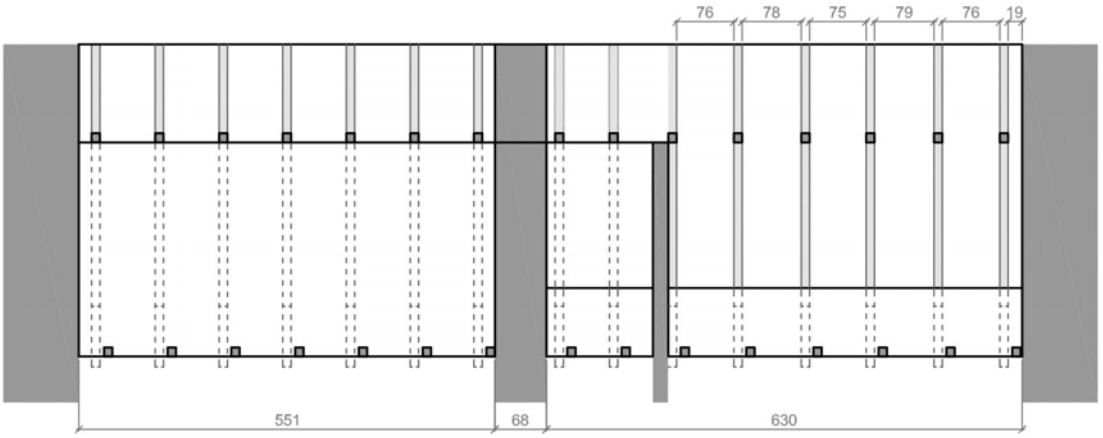
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** KELBURN CASTLE | **Roof location** 2: W wing

Survey date(s) 09/07/2015 | See drawing: KC-W-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 5.6 | Roof Height [m]: 4.14

Roof Pitch/es [°]: 51 | Roof Length [m]: 12.5

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.75

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 2

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1722 To | Identified by: Estimated

Roof General Description: Gabled roof composed of 16 frames with an intermidiate supporting wall. Frames have possibily two collars (one visible, one under the floor boards) and rafter feet. The timbers are all full logs hand axed and hand sawn. Some of the original timber pegs used to secure the slates to the sarking are still in place.

Roofing Material: slate

Roofing Material Fixing: Timber Pegs

Timber elements' Section Shape: Rectangular with wanes, Square with wanes

Rafter Scantling [cm] H: 11 B: 11 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Rafters' apex: mortice and tenon with timber pegs not flush. Between rafter and collar: lapped with metal nail.

Wood Species: the structure seems to be oak, the sarking pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Few visible.

Signs of reused timbers: redundant joints in rafters, but probably because collars were moved

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber elements' dressing | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Redundant joints | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance, presence of water tank

Accessibility limitations: Connection with wall only visible in a small portion of the roof structure

Past interventions: Some double rafters and collars added, as well as tie-beams.



Fungi attack | link I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

Fungi attack on some timber elements - active, that's why they stripped off the plastering

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes: Repair works are undergoing (July 2015)

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

KINROSS HOUSE

Location: PERTH AND KINROSS | KINROSS

X coordinate: 312637 Y coordinate: 702044

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 27882

Original Use: Residential

Current Use: Hotel/Inn, Meeting Hall

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1550	1583	OLDER HOUSE ON ANOTHER SITE - NOTHING REMAINS	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1679	1693	ROOF DONE BY 1691 - INTERIORS STARTED IN 1692 - IT WAS LEFT UNFINISHED	GLENDINNING 2004

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT, COMMISSIONERPATRON	☐
EDWARD	ALEXANDER	DESIGNER	☐
BACHOP	TOBIAS	MASTER MASON	☐
MERCER	JAMES	CARVER	☐
OLIPHANT	THOMAS	WRIGHT	☐
BENNETT	ROBERT	WRIGHT	☐
FAIR	JOHN	WRIGHT	☐
VAN NERVEN	CORNELIUS	PLASTERER	☐
BOYS	PETER PAUL	PLASTERER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION, CONSERVRESTOR	1777	1790	REPLACEMENT OF WINDOWS, DEMOLITION OF ENTRANCE LODGES, INTERIOR ALTERATIONS, LOWERING OF THE GROUND ABUTTING THE BASEMENT FLOOR, CONSTRUCTION OF STABLE COURTYARD	SIMPSON AND BROWN REPORT

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR, DEMOLITION	1845	1855	REPAIRS TO THE ROOF, THE CEILING WAS LOWERED, AND THE MUSICIAN'S GALLERY BLOCKED - WINGS DEMOLISHED	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1863	1869	ROOF RENEWED - SOME 17C TIMBERS REMAIN OVER THE NORTH AND SOUTH PAVILION ENDS, PARTICULARLY OVER THE STATE STAIR AND THE CUPOLA	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION, LANDSCAPE	1899	1928	INTERIORS, STABLES, LODGES REBUILT, SOME LANDSCAPING AND PLANTING	SIMPSON AND BROWN REPORT

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1904	1906	INTERIORS - ALSO PLASTER CEILING	CANMORE

People involved:

Last Name	First Name	Role	Attributed
ROSS	THOMAS	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2011	2013	EXTENSIVE CRACKING BETWEEN INNER CROSS WALLS AND EXTERNAL SOLID WALLS AS A RESULT OF HISTORIC SETTLEMENT - STAINLESS STEEL HELIBARS AND GROUTED CEMTIES WERE USED TO STITCH CRACKS AND RESTORE THE INTEGRITY OF THE MASONRY	CANMORE

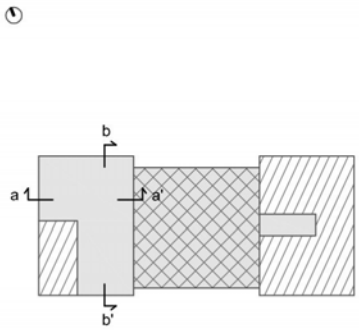
People involved:

Last Name	First Name	Role	Attributed
3DREID		ARCHITECT	☐
SIMPSON & BROWN		ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	79-80
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	119
GIFFORD J.	2007	☐	THE BUILDINGS OF SCOTLAND COLLECTION: PERTH AND KINROSS	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	72, 84
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	12
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	14
SIMPSON & BROWN ARCHITECTS	2010	☑	KINROSS HOUSE CONSERVATION PLAN	
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 61, 62

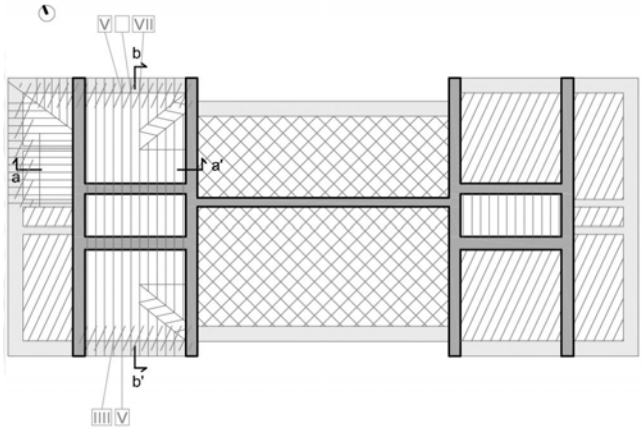
Suggestions for further research: NRS: GD29 Bruce papers and accounts - GD1/51/62 accounts 1688-90 - GD18/1859, 18C - RHP8787 Survey of Kinross 18C



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

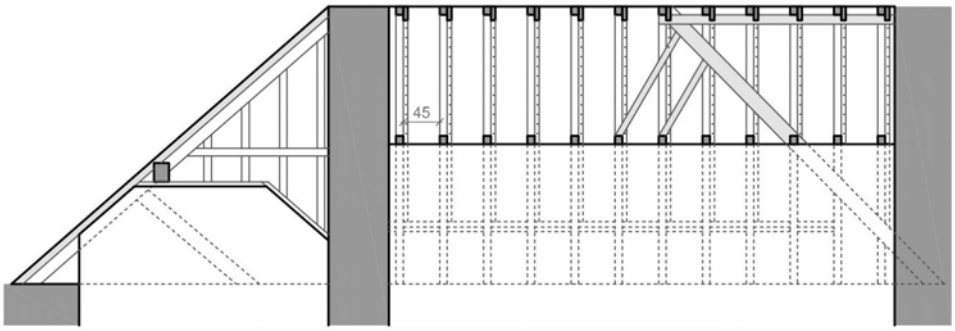
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

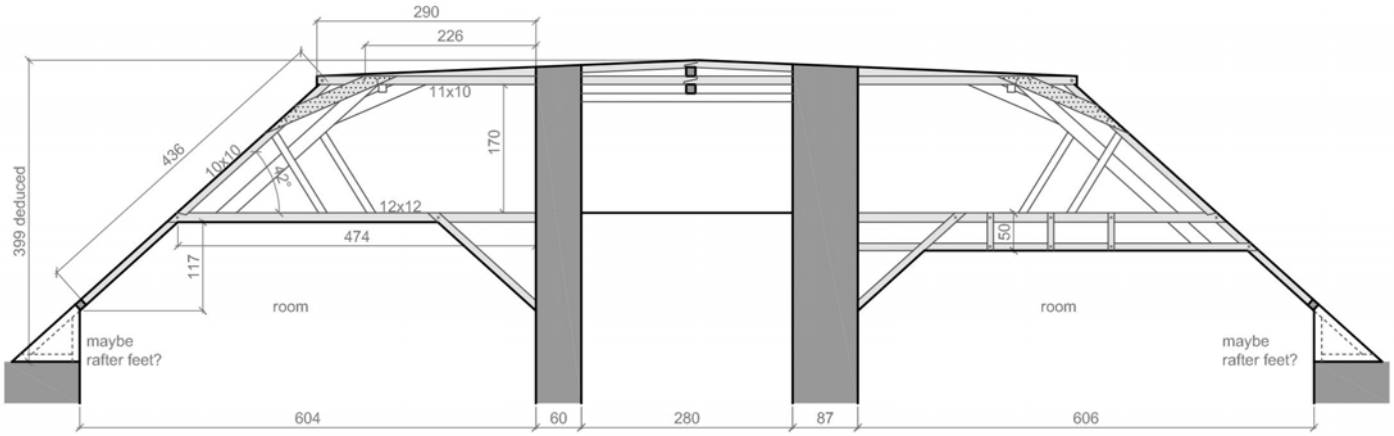
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A



Roof from inside I:\Arch\A

INITIAL SURVEY | **Building name** KINROSS HOUSE | **Roof location** Main block

Survey date(s) 10/11/2015 | See drawing: KH-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 6.04 | Roof Height [m]: 3.89

Roof Pitch/es [°]: 42 | Roof Length [m]: 39.8

Type of Primary Structure: 2D framing, Purlins

Truss ☐

Frame ☑ Other

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables: rafters

Roof Construction Period: From 1679 To 1693 Identified by: Estimated

Roof General Description:

Hipped platform roof with transversal walls as supports. Central section replaced in 19C. East section not accessible, esxcept for a small part. West section covered with a purlin roof on the East side, and with a 'platform frame' (like Melville, Holyrood, etc) in the West side. The purlin roof has been altered in the 19C. It is visible but not measurable. The West section has been strengthened but the original structure remains: it has upper horizontal beams supported by two transversal walls and joining the rafter upper ends on the sides (this joint has been reinforced later with short struts): collars join the rafters to the walls and slanted

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 12 B: 12 Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed) Bark ☑

Joint Types: dovetail, lapped, mortice and tenon, scarf

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Between upper beam and rafter: mortice and tenon with timber peg not flush. Between rafter and collar: dovetail lapped with metal nail.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Only two visible

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology



Roof structure: 2D framing link I:\Arch\A



Roof structure: purlin roof link I:\Arch\A



Timber dressing link I:\Arch\A



Joint: rafter and upper beam link I:\Arch\A



Joint: beams in central part link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with the wall not visible

Past interventions: Central part of the roof completely replaced in 19C. 19C and 21C timbers reinforcing the original timbers in the lateral parts. Sarking replaced.

Material Degradation: Fungi attack ☑ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☑

Water ingress close to walls. Insect and fungi attack on many timbers.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber



Past interventions: lateral part | link | I:\Arch\A



Past interventions: central part | link | I:\Arch\A



Water ingress | link | I:\Arch\A



Insect attack | link | I:\Arch\A



Fungi attack | link | I:\Arch\A

MALLENY HOUSE

Location: EDINBURGH, CITY OF | CURRIE
X coordinate: 316485 Y coordinate: 666552
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC
Protection status: NATIONAL
HS Listing: A Rcahms ID: 50278

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1635		INCORPORATING EARLIER WORK - THERE IS A 1589 DATE ON THE KITCHEN CHIMNEY	RCAHMS

People involved:

Last Name	First Name	Role	Attributed
MURRAY	SIR JAMES	ARCHITECT, COMMISSIONERPATRON, WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1820		ONE STOREY, KNOWN AS THE GEORGIAN WING, WAS ADDED TO THE NORTH	RCAHMS

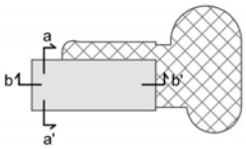
People involved:

Last Name	First Name	Role	Attributed
SCOTT	GENERAL THOMAS	COMMISSIONERPATRON, DESIGNER	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	

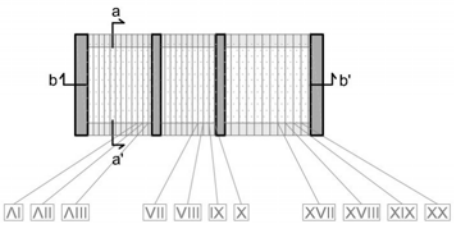
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

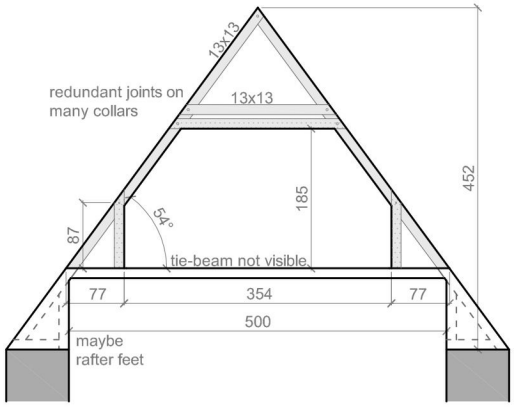
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

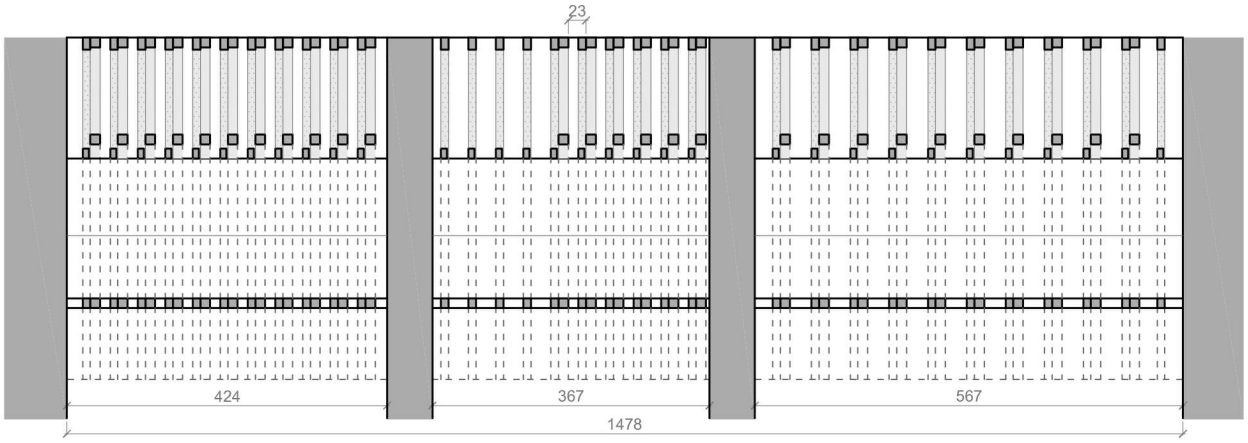
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** MALLENY HOUSE | **Roof location** Main block

Survey date(s) 22/08/2014 | See drawing: MNH-MB-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 5 | Roof Height [m]: 4.52

Roof Pitch/es [°]: 54 | Roof Length [m]: 14.78

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.23

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1635 To | Identified by: Estimated

Roof General Description:

Two-pitch gabled roof supported by frames with two collars (one visible and one under the floor boards) and ashlar posts (probably added later, when plastering was put up to make rooms). There might be rafter feet, but the connection with the wall is not visible. All timbers are full logs roughly squared with a hand axe. The frames have been doubled probably in 19C. The timbers are numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 13 | B: 13 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Between rafters and collars: lapped with timber pegs not flush.
Rafters' apex: mortice and tenon with timber pegs not flush.
Between ashlar posts and rafters: metal nails, no joint.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Few visible are in sequence

Signs of reused timbers:

Some collars have redundant joints and look older than the rest

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Frames doubled and sarking replaced probably in 19C. Few frames replaced completely.



Past interventions | link | I:\Arch\A



Material degradation | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Insect attack in collars and rafters' apex mainly, not sure if active

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link | I:\Arch\A

Other Notes: The house was built in 1635, probably incorporating an older 16C core. It seems some 16C timbers were reused in the 17C roof.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

MAYBOLE CASTLE

Location: SOUTH AYRSHIRE | MAYBOLE
X coordinate: 230130 Y coordinate: 610031
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 41650

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1600	1625		HS

People involved:

Last Name	First Name	Role	Attributed
KENNEDY	JOHN 6TH EARL OF C	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1660		PROJECTING TWO STOREY SOUTH-WEST WING	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1800		17TH CENTURY, ENLARGED IN 19TH	RCAHMS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1849	1850	WINDOWS ON FIRST FLOOR AND TWO STOREY ADDITION TO NORTH	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1917		FIRE	CHRIS SAVAGE

People involved:

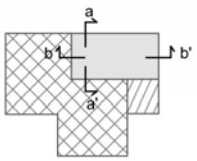
Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2014		ONGOING	CHRIS SAVAGE

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CLOSE R.	2012	☐	THE BUILDINGS OF SCOTLAND COLLECTION: AYRSHIRE AND ARRAN	
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME III. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	498-502
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	15

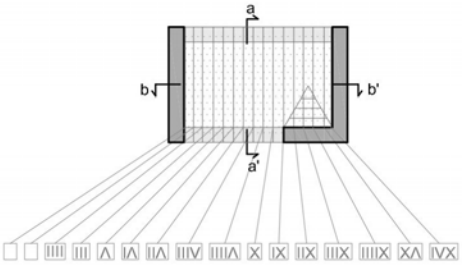
Suggestions for further research: NRS: miscellaneous papers (GD25/9/44)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

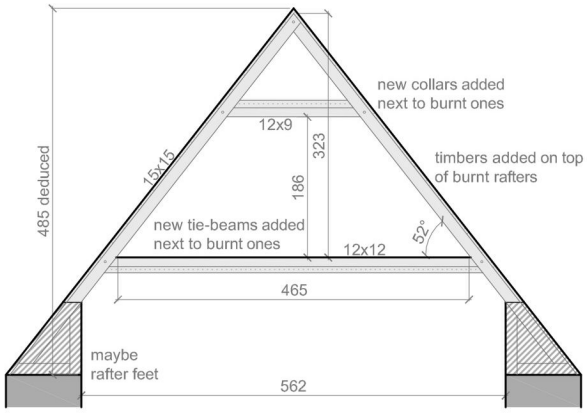
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

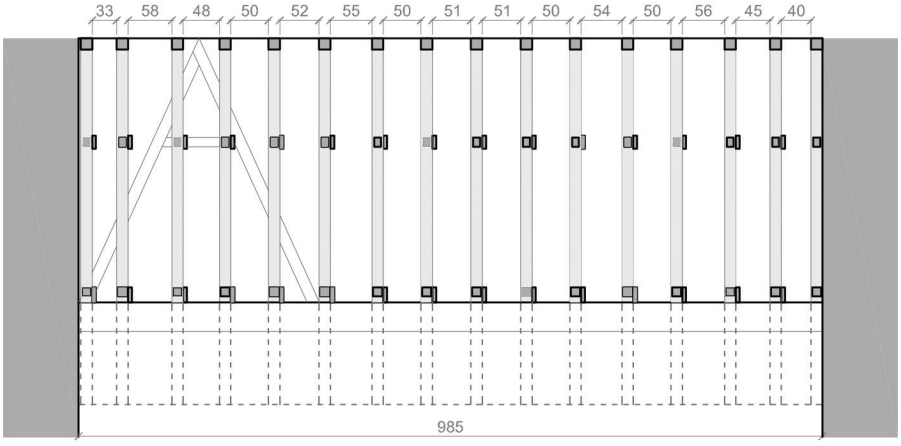
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** MAYBOLE CASTLE | **Roof location** N range of tower house

Survey date(s) 26/09/2014 | See drawing: MYC-N-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.62 | Roof Height [m]: 4.92

Roof Pitch/es [°]: 52 | Roof Length [m]: 9.85

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables

Roof Construction Period: From 1600 To 1625 Identified by: Estimated

Roof General Description: Two-pitch gabled roof with intersection on the South, interrupted by gable wall. The roof is composed of closely spaced rafter couples connected trasversally by one collar and longitudinally by sarking boards only. The connection with the wall is embedded in masonry; there might be rafter feet. All the timbers are covered with a thick layer of char because the roof has burnt in 1917. The frames have been doubled to reinforce the original timbers. Big sawn roman numerals number the frames.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes, Square with wanes

Rafter Scantling [cm] H: 15 B: 15 | Or Purlin - H: B:

Timber elements' Dressing | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush

Wood Species: can't say because of char | Way of identification:

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Mostly in sequence from 5 to 16 from north to south. Number 3 and 4 are switched and the first two don't have any visible marks.

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation, presence of pigeons/wasps/bats

Accessibility limitations: Connection with wall not visible

Past interventions: Frames doubled (collars and tie-beams, rafters only strengthened with boards a few centimeters thick) after 1917 fire. Most of the original timbers, although very damaged, left in situ. Probably at this time the sarking was replaced.



Past interventions | link | I:\Arch\A



Material degradation | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☐

problems of dry rot in all the house, and insect attack in some rafters, not sure if active

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	other	Intervened on	Primary
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☑ fire
- Other ☐

link

Description of visible damage: Many problems with humidity, dry rot and pigeons' droppings. The pigeons block the gutters, so the rain water overflows, damaging the outside walls. Dry rot affecting almost all the outside walls, and passing to the timbers. No ventilation. There is a crack running from basement to 4th floor and separating the south façade from the rest of the building.

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui

link

MELVILLE HOUSE

Location	FIFE		MONIMAIL
X coordinate	329893	Y coordinate	713801
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PRIVATE		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	30153
Original Use	Residential		
Current Use	Residential		

Freestanding ☑ N. of floors above ground level 4 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1697	1703		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	ARCHITECT	☐
BRUCE	SIR WILLIAM	DESIGNER	☐
MELVILLE	GEORGE 1ST EARL O	COMMISSIONERPATRON	☐
EDWARD	ALEXANDER	DESIGNER	☐
MCKENZIE	KENNETH	WRIGHT	☐
CARNABY	JOHN	PLUMBER	☐
HUTCHISON	JAMES	SLATER	☐
INNES	JAMES	SLATER	☐
BANNATYNE	ROBERT	GLAZIER	☐
ALBORN	THOMAS	PLASTERER	☐
MELVILLE	JOHN	PLASTERER	☐
CHRISTIE	JOHN	PLASTERER	☐
KYLE	THOMAS	JOINER, WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1800	1899	INTERIORS RECAST	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1800	1825	PORCH TO NORTH	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1939			HS

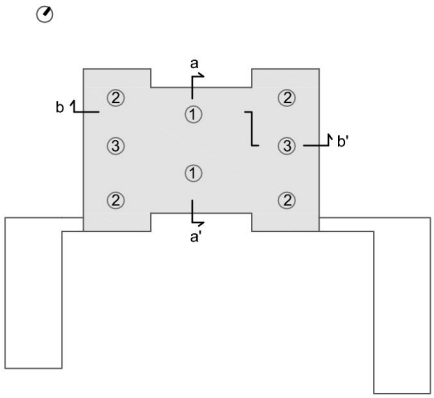
People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
ARC ARCHITECTS	2003	☑	HISTORIC AND ARCHITECTURAL INFORMATION RELATING TO MELVII	
GIFFORD J.	1988	☐	THE BUILDINGS OF SCOTLAND COLLECTION: FIFE	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	86

Suggestions for further research: NRS: GD 26/13/276 (Wage book for workmen and masons - 1747); GD 26/5/564 (Payment for building a new house at Melville

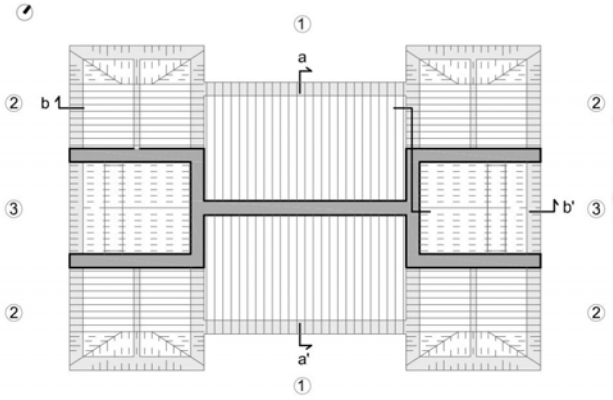
in 1697. Earl of Leven, James Smith and his partner - 1726); GD 26/6/164 (Providing a lead roof. Contract between George, Earl of Melville and John Carnaby, plumber - 1699); GD 26/6/158 (Description of house 1778); GD 126/Box 30 (late 19th century photograph); RHP4093 Smith drawings (RHP4093/6 roof plan)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



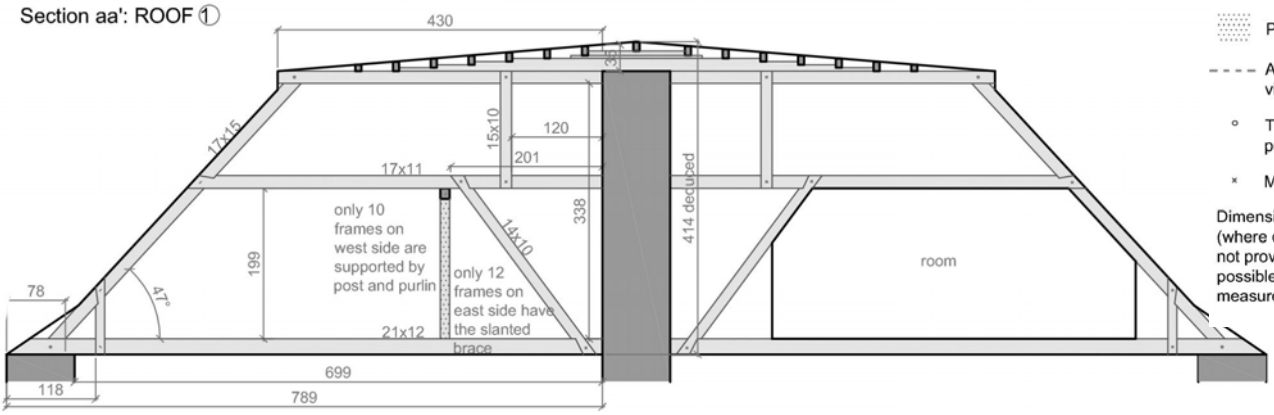
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

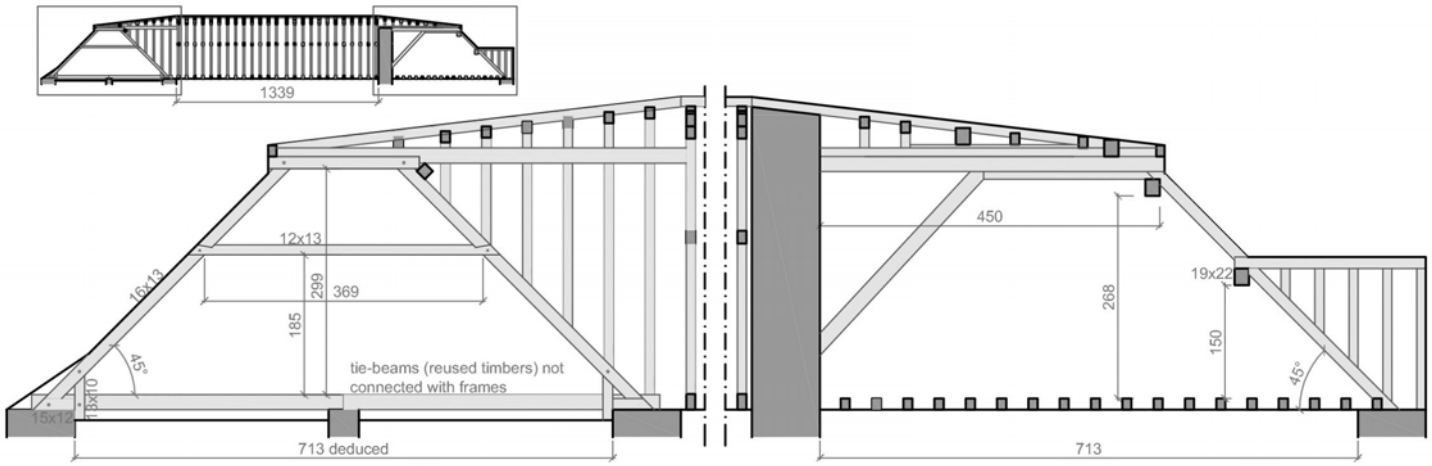
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section aa': ROOF ①



Section bb': ROOF ②and ③



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** MELVILLE HOUSE | **Roof location** 1: main block, central part

Survey date(s) 08/07/2015 | See drawing: MVH-all-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 7 | Roof Height [m]: 4.1

Roof Pitch/es [°]: 47 | Roof Length [m]: 13.4

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Other, Struts

Average Distance in between Primary Structure [m]: 0.42

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tension ashlar post, Tie-beam

Connection with gables: rafters

Roof Construction Period: From 1697 To 1703 Identified by: Estimated

Roof General Description:

Hipped platform roof supported by intermediate trasversal walls and different typologies of roof timber structures. The central part is supported by complex frames composed of rafter couples joining a horizontal upper beam that rests on the intermediate wall. A collar and a tie-beam connect the rafter to the wall. A pair of vertical and slanted struts on each side connect the tie-beam to the collar and the upper beam. A tension absorbing ashlar post connects the tie-beam to the rafters. The timbers are all full logs hand axed and numbered with big sawn roman numerals and other unusual carpentry marks

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 17 B: 15 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) Bark ☑

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Between rafters and upper and lower beams: mortice and tenon with timber pegs not flush. Between rafters and collars and between collars and struts: chamfered dovetail lapped with one or more metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: arabic numerals, big roughly cut roman numerals, runic marks, small chiseled roman numerals

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure: central part link I:\Arch\A



Connection with wall link I:\Arch\A



Joints: struts and collar link I:\Arch\A



Timber elements' dressing link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Sarking replaced.



Past interventions link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:	
Roof Damage				link
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes: The lateral roofs seem to belong to a construction phase prior to the central part, because they have sarking on the inner sides. Morevoer, the rafter foot indicates a late 15C/early 16C construction technique?

Attachments link

INITIAL SURVEY | **Building name** MELVILLE HOUSE | **Roof location** 2: main block, corners

Survey date(s) 08/07/2015 | See drawing: MVH-all-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 7.1 | Roof Height [m]: 4.1

Roof Pitch/es [°]: 45 | Roof Length [m]: 5.9

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Other

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables: rafters

Roof Construction Period: From 1697 To 1703 | Identified by: Estimated

Roof General Description: Hipped platform roof supported by intermediate trasversal walls and different typologies of roof timber structures. The corners are supported by complex frames composed of rafter couples joining a horizontal upper beam and connected by a collar. The connection with the walls is provided by rafter feet. The timbers are all full logs hand axed and numbered with big sawn roman numerals and other unusual carpentry marks.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 16 | B: 13 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Between rafters and upper beams, as well as in rafter foot: mortice and tenon with timber pegs not flush. Between rafters and collars: chamfered dovetail lapped with one or more metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Signs of reused timbers: Tie-beams not connected to frames and have redundant joints at their ends (they might have been collars or rafters)

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafters and upper beams | link I:\Arch\A



Timber elements' dressing | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Sarking replaced. Some rafters replaced. Insulation added.



Past interventions | link | I:\Arch\A



Material degradation | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Some insect attack, not sure if active.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes: The lateral roofs seem to belong to a construction phase prior to the central part, because they have sarking on the inner sides. Morevoer, the rafter foot indicates a late 15C/early 16C construction technique?

Attachments

link

INITIAL SURVEY | **Building name** MELVILLE HOUSE | **Roof location** 3: main block, sides

Survey date(s) 08/07/2015 | See drawing: MVH-all-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 6.8 | Roof Height [m]: 4.1

Roof Pitch/es [°]: 45 | Roof Length [m]: 7.1

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, sarking | Plane: roof plane

Sarking boards: width [cm]: | thickness [cm]:

Connection with lateral walls: Wall-plate

Connection with gables: purlins

Roof Construction Period: From 1697 To 1703 | Identified by: Estimated

Roof General Description:

Hipped platform roof supported by intermediate trasversal walls and different typologies of roof timber structures. The sides are supported by purlin roofs, with two purlins each, supported by the intemrediate walls. The ridge purlin is also supported by a timber strut, which looks more recent (either replaced or added).The purlins support common rafters, secondary purlins and sarking boards.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: | B: | Or Purlin - H: 19 | B 22

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types:

Fasteners Types:

Joints description:

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A

link

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Sarking replaced. Some common rafters replaced. Insulation added. Strut replaced or added.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Permanent Deformation	Unknown	Primary
Connection Damage			



Damage: deflected purlin | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient overall arrangement, insufficient dimensions
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: Purlins are deflected

link

Other Notes: The lateral roofs seem to belong to a construction phase prior to the central part, because they have sarking on the inner sides. Morevoer, the rafter foot indicates a late 15C/early 16C construction technique?

Attachments | link

METHVEN CASTLE

Location: PERTH AND KINROSS | METHVEN
X coordinate: 304162 Y coordinate: 726043
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 26808

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION, CONSTRUCTION	1000	1500	A CASTLE HERE WAS IN THE HAND OF THE MOWBRAYS IN THE 11TH CENTURY, AND IS MENTIONED IN THE 14TH AND 16TH CENTURIES.	RCAHMS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1678	1681		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	ARCHITECT	☑
MYLNE	JOHN JUNIOR (3)	ARCHITECT, MASON	☑
SMYTH OF BRACO	PATRICK	MASON	☐

Intervention type:	From:	To:	Description:	Reference:
DESIGN	1813		FOR GOTHIC ADDITION NEVER CARRIED OUT	CANMORE

People involved:

Last Name	First Name	Role	Attributed
GRAHAM	JAMES GILLESPIE	DESIGNER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1960	1970	DEMOLISHED WEST WING, PORCH, CLOCKTOWER	CANMORE

People involved:

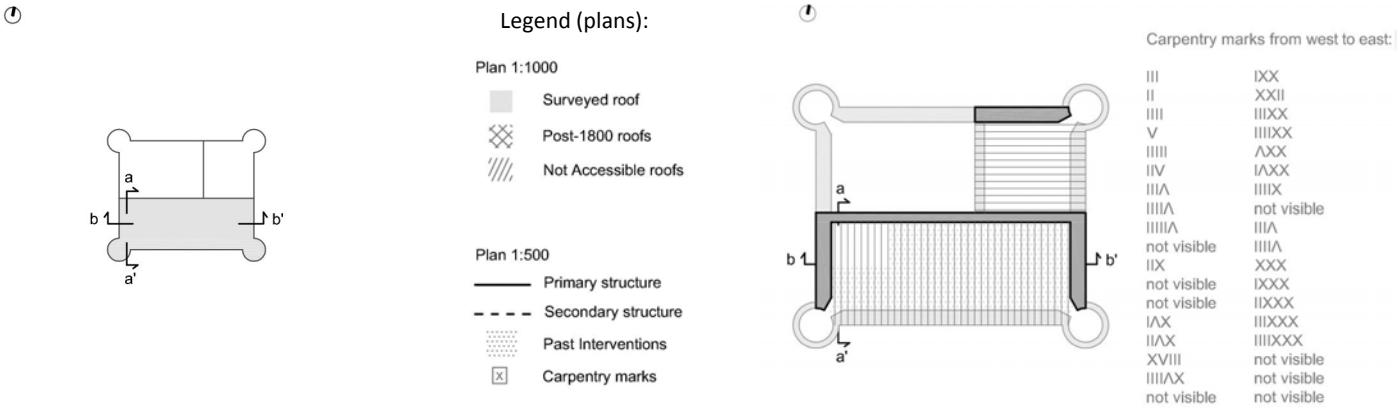
Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1984	1985	REMADE FLOORS AND ROOF ON SOUTH SIDE AND ALL INTERIORS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	278
GIFFORD J.	2007	☐	THE BUILDINGS OF SCOTLAND COLLECTION: PERTH AND KINROSS	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	77
MURDOCH D.	2010	☐	MY LOVES BONNIE STRONG HOUSE	
NEWLAND K.	2010	☑	THE ACQUISITION AND USE OF NORWEGIAN TIMBER IN SEVENTEEN CENTURY SCOTLAND, WITH REFERENCE TO THE PRINCIPAL BUILDING JAMES BAINE, HIS MAJESTY'S MASTER WRIGHT	

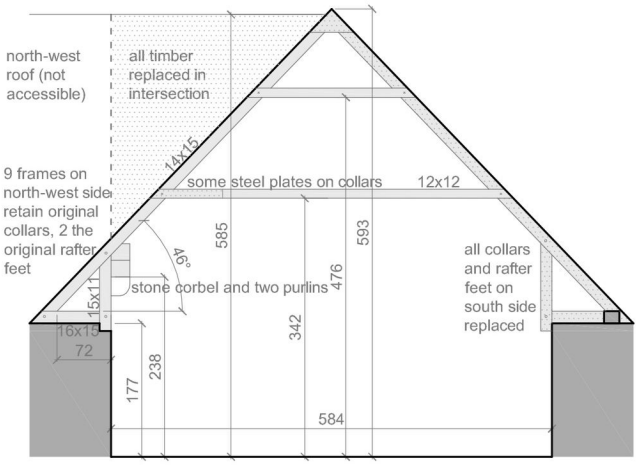
Suggestions for further research: Master dissertation by David Murdoch and book by his father
NRS: account sof works 1704/35 (GD190/3/255)



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'

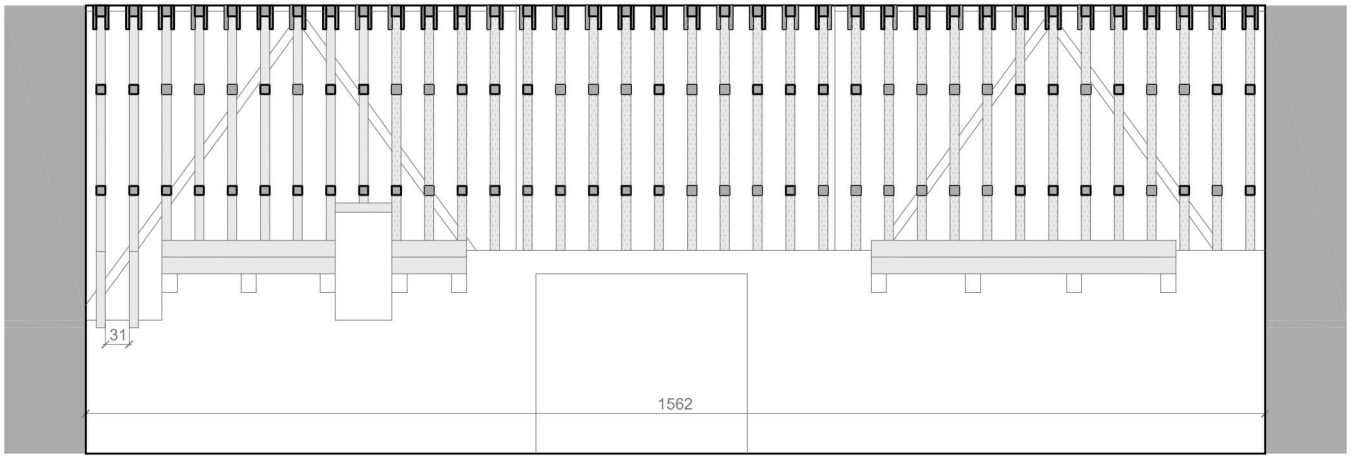


Legend (section):

- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** METHVEN CASTLE | **Roof location** 1: S part

Survey date(s) 29/07/2015 | See drawing: MTC-S-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.84 | Roof Height [m]: 5.92

Roof Pitch/es [°]: 46 | Roof Length [m]: 15.6

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.3

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 3

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1678 To | Identified by: Estimated

Roof General Description:

Two-pitched gabled roof with two intersections to the North interrupted by gable walls. Composed of closely spaced rafter couples connected trasversally by two collars and longitudinally by sarking boards only. The connection with the wall is provided by rafter feet (or purlins on stone corbels). Most of the timbers have been replaced, but a couple original rafter feet remain, as well as most collars. The timbers are all full logs roughly hand axed and numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular, Square with wanes

Rafter Scantling [cm] H: 14 | B: 15 | Or Purlin - H: | B:

Timber elements' Dressing: civil (machine-sawn), rustic (hand-axed) | Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Between rafter and collar: lapped chamfered with metal nail. Rafters' apex not visible. In rafter foot mortice and tenon with timber peg not flush.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Not in sequence.

Signs of reused timbers:

Timber Treated ☐

Other Materials: Steel plates

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks and dressing | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: All rafters and rafter feet on south side, and most of the ones on north side, replaced in 1980s because rotten (rafter feet were embedded in masonry). 9 Original rafters remain, and 2 original rafter feet (on west side). Original collars retained, some have steel plates to reinforce joint with rafter. All sarking replaced, as well as timbers in intersection roof.



Past interventions link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

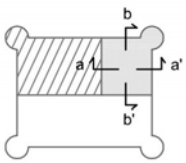
Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes: They kept pieces of original rafter feet, sarking, slates, metal nails and timber pegs. The timbers used for the rafters come from a 19C distillery.

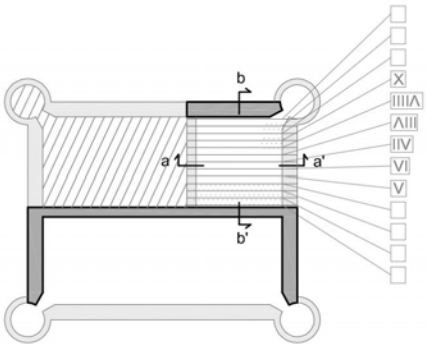
Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

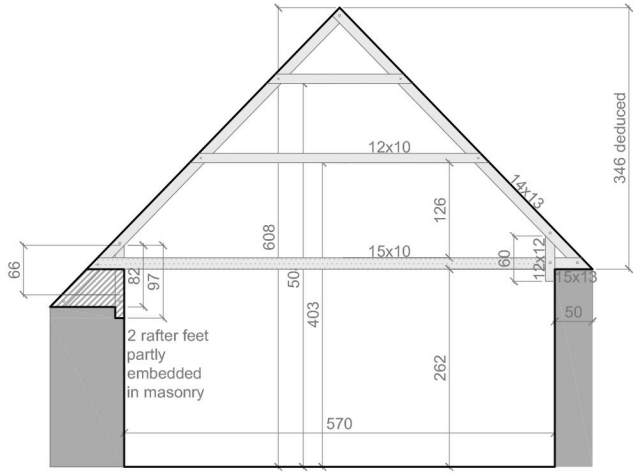
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

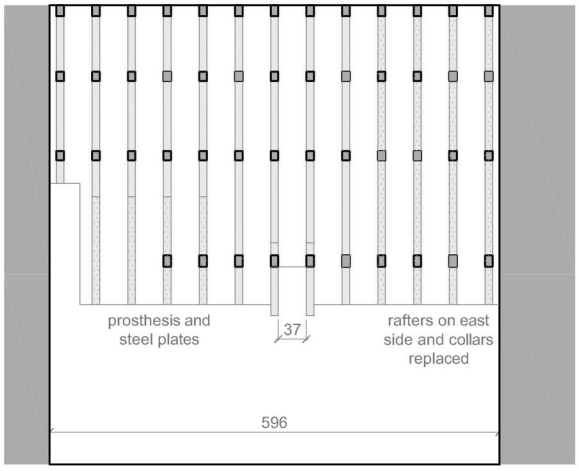
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** METHVEN CASTLE | **Roof location** 2: NE part

Survey date(s) 29/07/2015 | See drawing: MTC-NE-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 5.7 | Roof Height [m]: 3.46

Roof Pitch/es [°]: 46 | Roof Length [m]: 5.96

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.35

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1678 To | Identified by: Estimated

Roof General Description:

Two-pitched gabled roof composed of closely spaced rafter couples connected trasversally by three collars (the lowest one is embedded in masonry to the side of the rafter feet) and longitudinally by sarking boards only. The connection with the wall is provided by rafter feet: the ones on the East side are placed at a higher level and are smaller. The timbers are all full logs roughly hand axed and numbered with big sawn roman numerals.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 14 | B: 13 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg flush, Timber peg not flush

Joints description:

Rafters' apex: mortice and tenon with timber peg not flush. Between rafter and collars: lapped chamfered with metal nail. In rafter foot all mortice and tenon with timber peg flush.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Not all visible, but visible ones are in sequence.

Signs of reused timbers:

Timber Treated ☐

Other Materials: Steel plates

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber element's dressing | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Tie-beam replaced in lower position. Some rafter ends cut and prosthesis applied with steel plates. Sarking replaced.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

OAKSHAW TRINITY CHURCH

Location: RENFREWSHIRE | PAISLEY (RENFREW)

X coordinate: 248073 Y coordinate: 664109

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 43169

Original Use: Church

Current Use: Church

Freestanding: ☑ N. of floors above ground level: 1 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1754	1756		CANMORE

People involved:

Last Name	First Name	Role	Attributed
WHITE	JOHN	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1770		STEEPLE	CANMORE

People involved:

Last Name	First Name	Role	Attributed
WHITE	JOHN	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1877		INTERIOR RECAST	CANMORE

People involved:

Last Name	First Name	Role	Attributed
RENNISON AND SCOTT	ARCHITECTS	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1994		REPAIR/STRENGTHENING OF THE TIMBER ROOF STRUCTURE	JOHN ADDISON

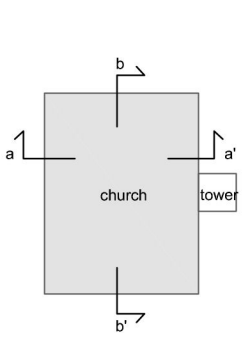
People involved:

Last Name	First Name	Role	Attributed
WALKER	GAVIN	ENGINEER	☐
RUTHBERTSON	JIM	ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
BROWN R.	1886	☐	HISTORY OF PAISLEY	
HAY G.	1957	☐	THE ARCHITECTURE OF SCOTTISH POST REFORMATION CHURCHES 1	
RIG L.	2014	☐	HTTP://WWW.GEOGRAPH.ORG.UK/PHOTO/3918504	
SINCLAIR SIR J. B.	1793	☐	OLD STATISTICAL ACCOUNT VOLUME SEVENTH	67

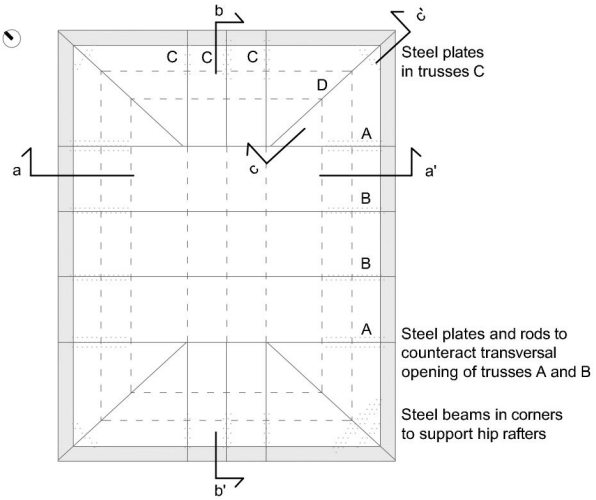
Suggestions for further research: Church convenor has documents on 1994 repairs



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

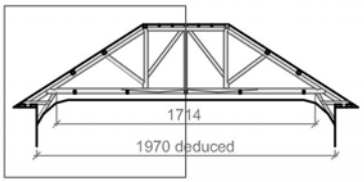
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks

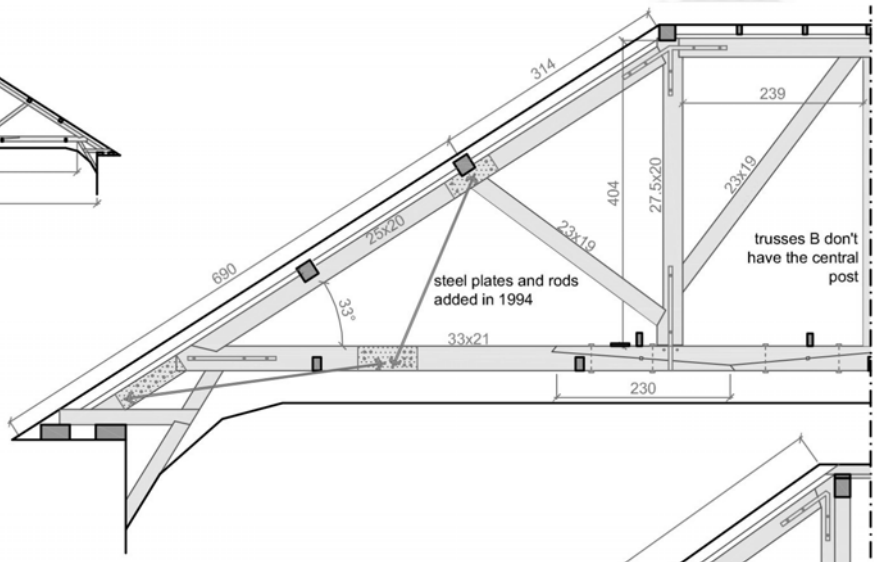


Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa': Truss A/B

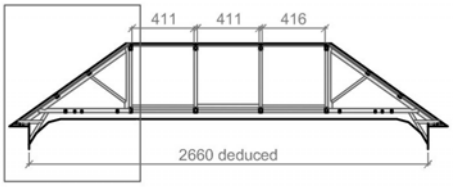


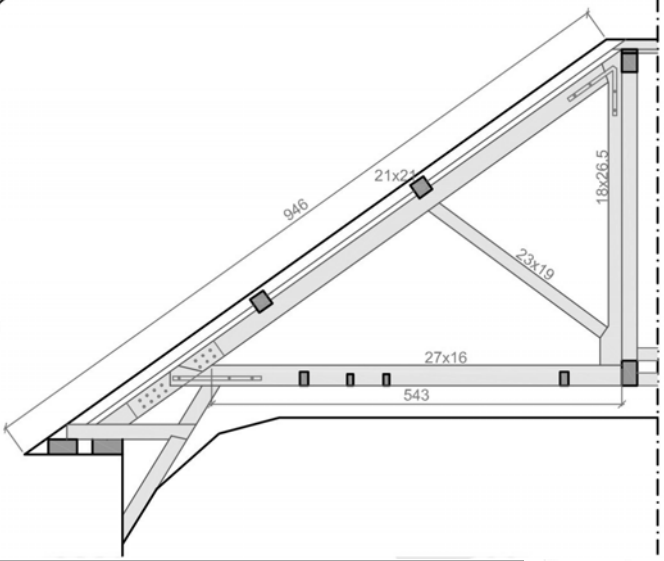


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

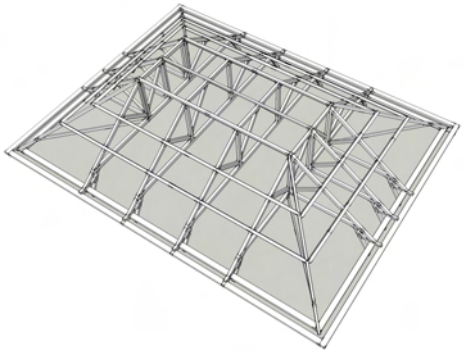
Section bb': Truss C



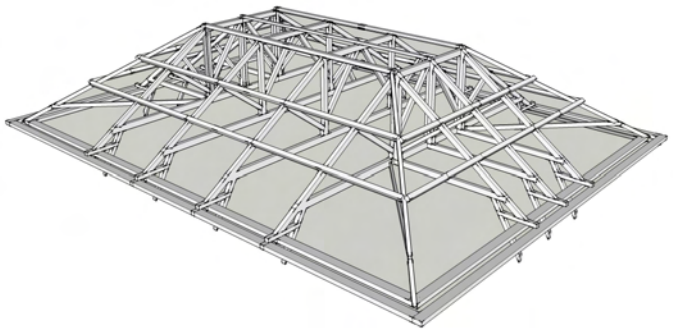


Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Perspective view I:\Arch\A



Perspective view I:\Arch\A

Building name: **OAKSHAW TRINITY CHURCH**

Roof location: Church main hall

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 20 | Roof Height [m]: 5.5

Roof Pitch/es [°]: 33 | Roof Length [m]: 26.6

Primary Structure Type: 2D framing

Truss ☑ QUEEN-POST

Frame ☐

Average Distance in between Primary Structure [m]: 4.13

Secondary Structure Type: common rafters, purlins, sarking

Sarking n. of layers | Sarking thickness [cm]

Connection with vertical load bearing system: Wall-plate

Roof Construction Period: From 1754 To 1756 Identified by:

Roof General Description: There are 4 main trusses spanning east-west. The tie-beams are composed of 5 elements. The 2 trusses in the middle have 2 posts, the trusses on the sides have 3 posts. The two side posts have two struts each, which are asymettrical. 5 purlins support the common rafters and sarking, 3 on top and 2 on each side. The tie-beam is raised so the rafters continue further down and form a triangle with a hammer-beam and an aShlar element.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 25 B: 20 Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: cleat, joggle, mortice and tenon, scarf

Fasteners Types: Metal strap, Timber dowel, Timber key

Joints description: All mortice and tenon with metal straps (except for struts which don't have metal straps); Tie-beams: scarf joints (very simple, with timber keys, low tension resistance). Posts have joggles at the top and bottom

Wood Species:

Carpentry Marks Types: big roughly cut roman numerals, lettering, small chiseled roman numerals, strange marks (from scandinavia?)

Carpentry Marks Description: C engraved close to some joints.

Signs of reused timbers: There are some redundant joints but they seem to be there because an element was removed rather than because the timbers have been reused

Timber Treated ☐

Other Materials: Metal straps and bolts (not sure if original or added later in the 18/beg19C). Steel beams, plates and rods added in 1994.

Dendrochronology:



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Timber elements' dressing link I:\Arch\A



Joints: lower part of lateral post link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Steel plates and cables installed in 1994 at the rafters ends to counteract the opening of the roof. Timber posts/braces and steel beams added to support the hip rafters in the same period.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	transversal opening	Intervened on	Primary
Unit Damage	Disconnection	Unknown	Collateral
Element Damage	Cracks, Permanent Deformation	Unknown	Collateral
Connection Damage	Disconnection	Unknown	Collateral



Damage: opening of joints | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient joints, insufficient dimensions
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☑ increase of dead loads, repair/consolidation
- Extreme actions ☐
- Other ☐



Damage: opening of joints | link | I:\Arch\A

Description of visible damage: The building is affected by several craks in the masonry and in the plaster ceiling. The cause is probably the horizontal thrust deriving from the roof timber structure that is opening both transversally and longitudinally (many joints are open up to 4.5cm). The causes of this opening are probably more than one, starting from the partial inefficiency of the original design, to the weight of the plaster ceiling, to the 1994 repair works. Settlements could be contributing as a cause too.



Damage: secondary beams cut | link | I:\Arch\A

Other Notes: More thorough survey of damage carried out. The 1994 interventions probably increased the loads on the timber structure and on the masonry. Moreover the wall-plates and many secondary elements were cut, weakening the corners and leaving no support for the ceiling in many locations.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber

PILMUIR HOUSE

Location: EAST LOTHIAN | BOLTON

X coordinate: 348631 Y coordinate: 669357

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 54661

Original Use: Residential

Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1624		T PLAN	HS

People involved:

Last Name	First Name	Role	Attributed
CAIRNS	WILLIAM	COMMISSIONERPATRON	☐

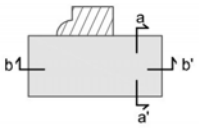
Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1700	1725		HS

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	4

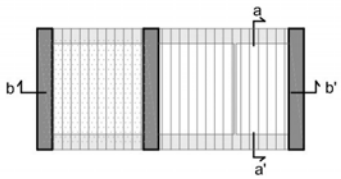
Suggestions for further research:



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



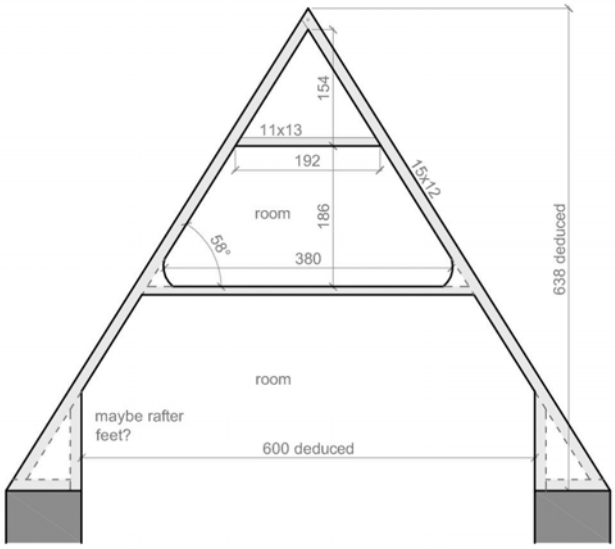
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

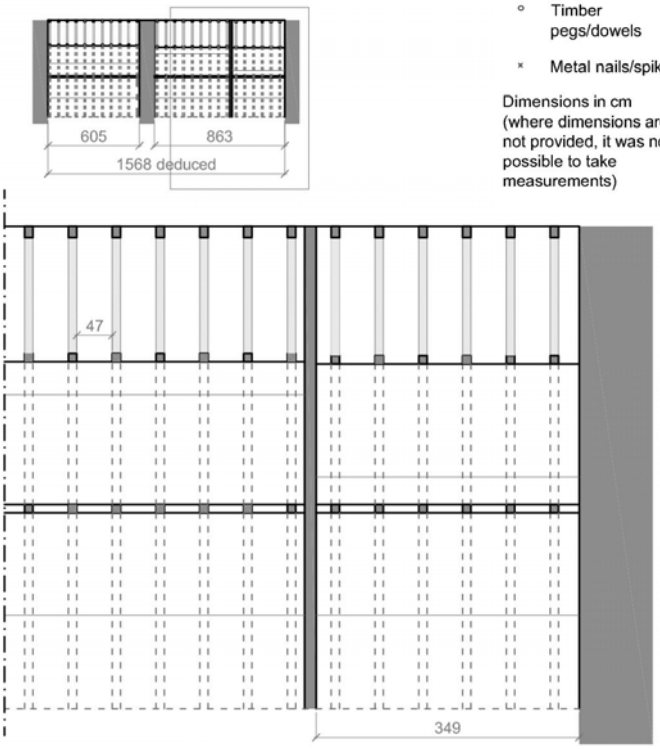
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section aa'



Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** PILMUIR HOUSE | **Roof location** Main block

Survey date(s) 08/10/2014 | See drawing: PLH-MB-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6 | Roof Height [m]: 6.38

Roof Pitch/es [°]: 58 | Roof Length [m]: 15.68

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1624 To | Identified by: Estimated

Roof General Description: Two-pitch gabled roof supported by one transversal wall. Composed of 26 frames with two collars each (only one visible). Connection with wall not visible but there could be a rafter foot. Very little of the structure is visible because it is mostly hidden behind plaster since the roof space is used as attic rooms. The timbers are full logs roughly hand axed.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 15 B: 13 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: Joint between rafters and collars not visible

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description: Not visible

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A

link

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: presence of pigeons/wasps/bats

Accessibility limitations: Most of the roof structure is not visible, especially the connection with the walls

Past interventions: Sarking replaced. Some new collars.



Past interventions | link | I:\Arch\A



Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Insect attack in some collars, not sure if active

Unfavourable conditions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Material degradation | link | I:\Arch\A

Description of visible damage

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

ROBERT GORDON'S COLLEGE

Location	ABERDEEN, CITY OF	ABERDEEN	
X coordinate	393880	Y coordinate	806496
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PRIVATE		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	130652
Original Use	School		
Current Use	School		

Freestanding ☑ N. of floors above ground level 4 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1731	1732	DESIGN SIMILAR TO THE ONE PRESENTED IN VITRUVIUS SCOTICUS	HS

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐
SMITH	JOHN (700)	ARCHITECT	☐

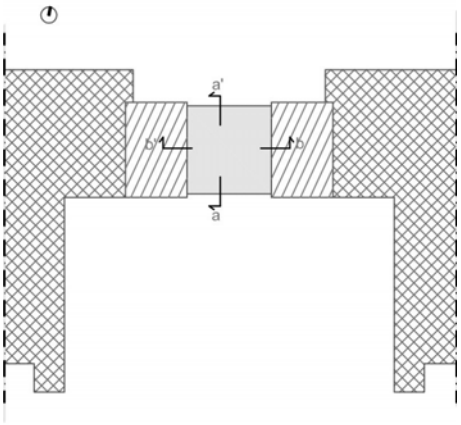
Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1830	1832		HS

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
WALKER D. & WOODWORTH M.	2015	☐	THE BUILDINGS OF SCOTLAND COLLECTION: ABERDEENSHIRE: SOUTI ABERDEEN	
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 107, 108

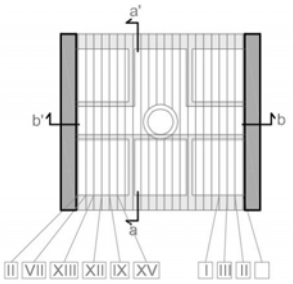
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

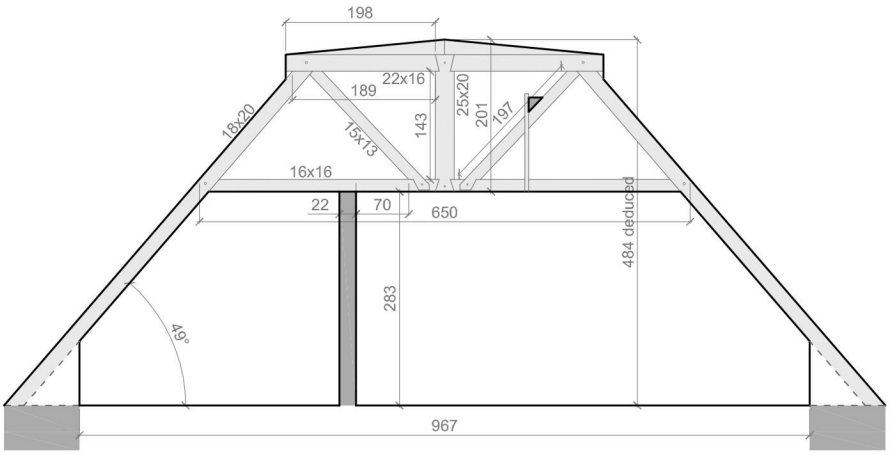
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

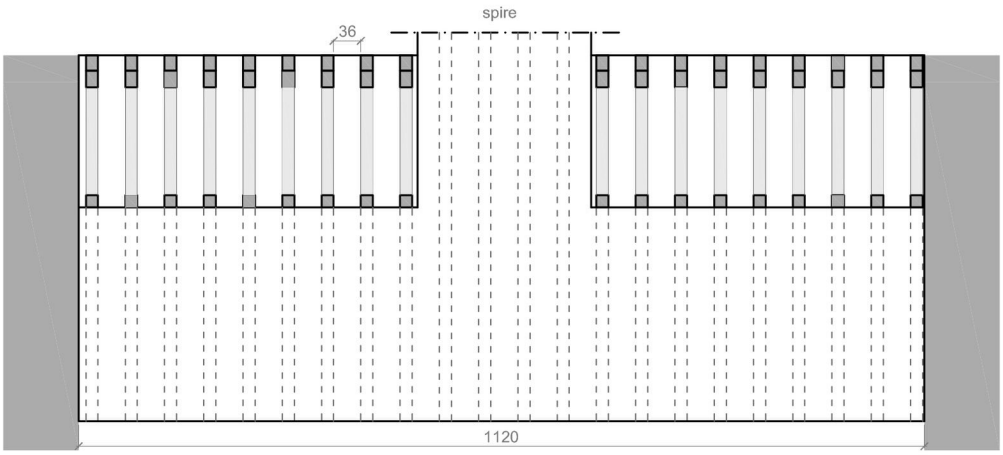
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof structure from outside I:\Arch\A



Roof structure from outside I:\Arch\A

INITIAL SURVEY | **Building name** ROBERT GORDON'S COLLEGE | **Roof location** Main block

Survey date(s) 05/08/2015 | See drawing: RGC-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 9.67 | Roof Height [m]: 4.84

Roof Pitch/es [°]: 49 | Roof Length [m]: 11.2

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Other

Average Distance in between Primary Structure [m]: 0.36

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1731 To 1732 | Identified by: Estimated

Roof General Description: Hipped platform roof supported by two transversal walls and 22 closely spaced complex frames. Each frame has a collar and an upper horizontal beam, a central post and two slanted struts on the sides. The 4 central frames are interrupted by the spire - this part could not be closely inspected.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 20 | B: 18 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Mortice and tenon with timber peg not flush between rafters and horizontal beams. Dovetail lapped with metal nail between post/struts and horizontal beams.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Not all visible, but the few visible are not in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: rafter and upper beam | link I:\Arch\A



Joints: post and lower beam | link I:\Arch\A



Carpentry marks and joints | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: The two sides of the main block are not accessible in safety

Past interventions: Few bits of sarking replaced



Past interventions link I:\Arch\A



link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Sarking on the slopes is extremely moist

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber

link

ROYSTON HOUSE

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)

X coordinate: 322654 Y coordinate: 677220

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Protection status: NATIONAL

HS Listing: A Rcahms ID: 52056

Original Use: Residential

Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1585		L PLAN TOWERHOUSE	HS

People involved:

Last Name	First Name	Role	Attributed
LOGANS	ANDREW	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1683	1696	QUADRANGLE: E JAMB EXTENDED, N AND W RANGES ADDED, S FRONT REMODELLED - PAUL HARDING THINKS THE COURTYARD ALREADY EXISTED BEFORE THIS DATE	HS

People involved:

Last Name	First Name	Role	Attributed
EIZAT	ALEXANDER	WRIGHT	☐
MACKENZIE	SIR GEORGE 1ST EAR	COMMISSIONERPATRON	☐
BAINE	WILLIAM	PLASTERER	☐
GAIRDNER	ALEXANDER	SMITH	☐
HEUDE	NICOLAS	PAINTER	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1740	1741	WING AND INTERIORS	HS

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐
CAMPBELL	JOHN 2ND DUKE OF	COMMISSIONERPATRON	☐

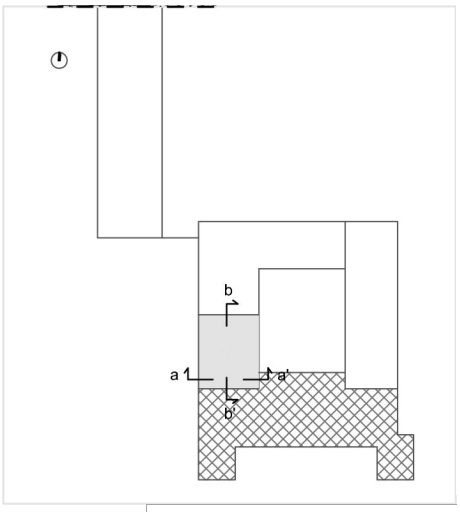
Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1930		FIRE DESTROYED SOUTH RANGE ROOF	OWNER

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME II. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL/ THE TWELFTH TO THE EIGHTEENTH CENTURY	453-463
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	

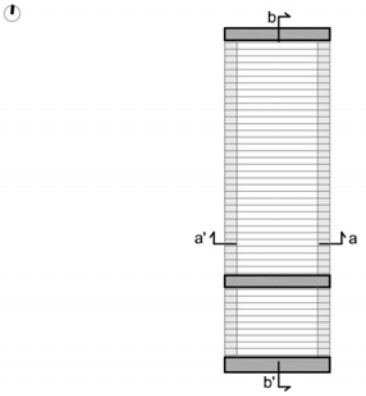
Suggestions for further research



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

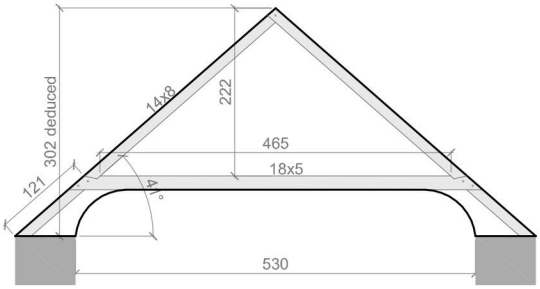
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

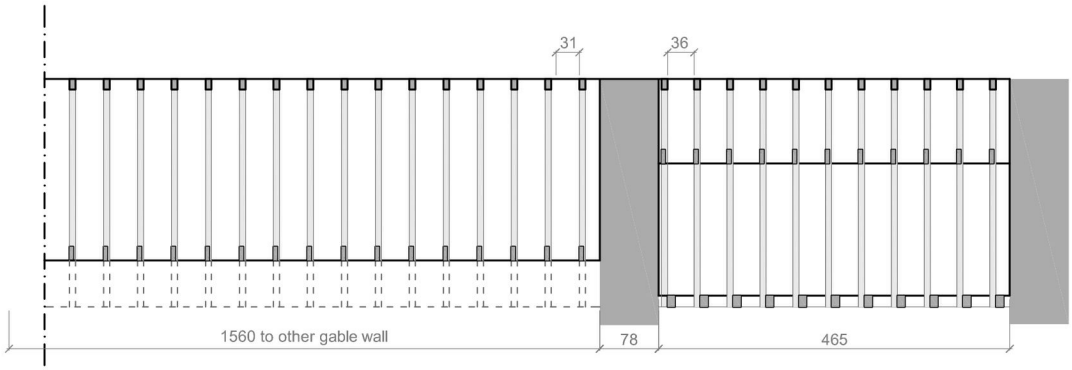
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY **Building name** ROYSTON HOUSE **Roof location** 3: E range

Survey date(s) 26/08/2015 See drawing: RH-E-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 5.3 Roof Height [m]: 3

Roof Pitch/es [°]: 41 Roof Length [m]: 21

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.42

Type of Secondary Structure: sarking Plane: roof plane

Sarking boards: width [cm] thickness [cm]

Connection with lateral walls: None

Connection with gables:

Roof Construction Period: From 1775 To 1800 Identified by: Estimated

Roof General Description: Two-pitch gabled roof with a transversal wall and 47 frames, composed of one collar in the North section, where the plaster ceiling is, and tie-beams not connected to rafters in the South section, where the ceiling is lower. It doesn't look contemporary to the wing, it's probably end 18C, because the timbers have rectangular scantlings and are hand axed.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 14 B: 8 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☑

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description: All lapped with metal nails - between collar and rafter dovetail chamfered

Wood Species: softwood, probably pine Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Joints: rafters' apex link I:\Arch\A



Joints: rafter and collar link I:\Arch\A



Carpentry marks and dressing link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features: Original plaster ceiling underneath

Unfavourable conditions:

Accessibility limitations:

Past interventions:

link

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	link
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

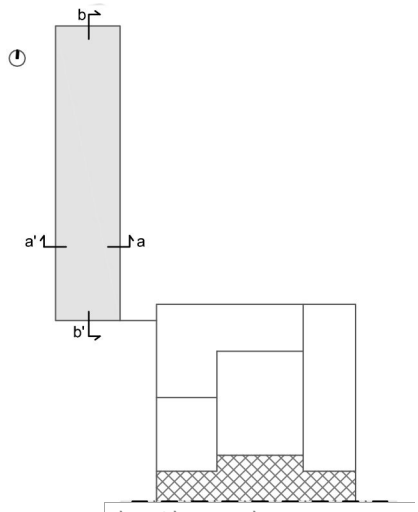
Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: link

Other Notes:

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link

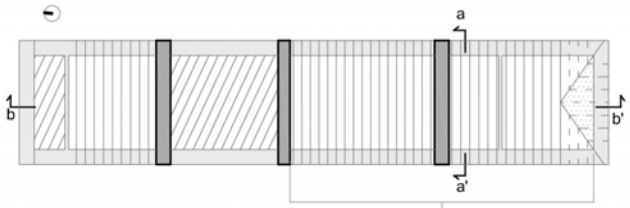


Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks

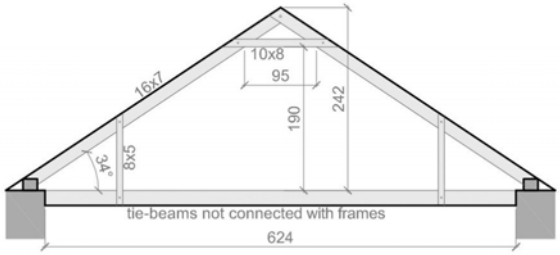


Carpentry marks from south to north:

XIII	XXXXXV	IIII
X	XXXXVIII	XXXXXVI
XII	XXXXXII	XXXXXIII
XV	not visible	XXXXXIIII
XIV	XXXXII	XXXXXII
XXXXIX	XXXXX	XXXXVII
VIII	VII	XX
not visible	V	IX
not visible	IA	XI
I	III	XXXX

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

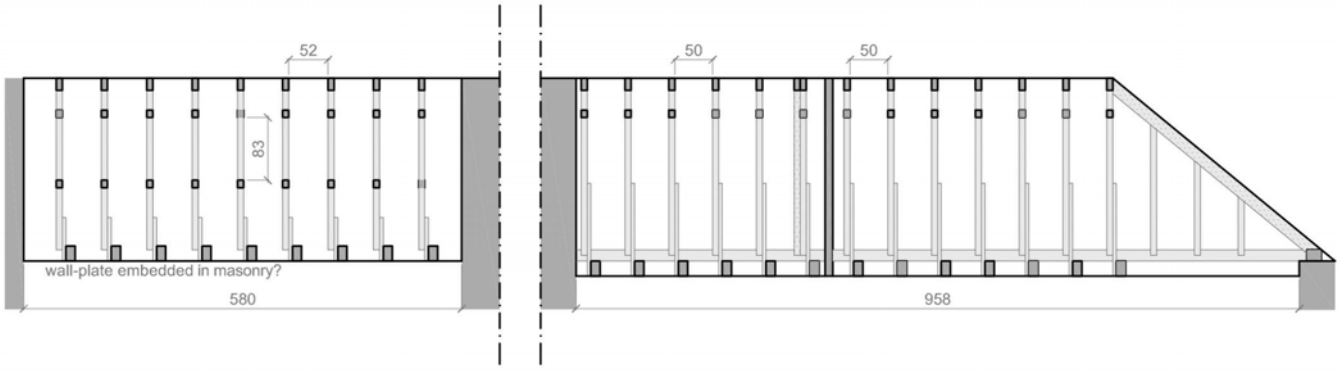
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** ROYSTON HOUSE | **Roof location** 2: wing

Survey date(s) 26/08/2015 | See drawing: RH-WI-1

Roof Geometry: Hipped

Roof Max Span [m]: 6.24 | Roof Height [m]: 2.42

Roof Pitch/es [°]: 34 | Roof Length [m]: 37.1

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables:

Roof Construction Period: From 1740 To 1741 | Identified by: Estimated

Roof General Description:

Two-pitch hipped roof supported by 3 transversal walls and closely spaced rafter couples connected trasversally by one short collar. The connection with the walls is provided by wall-plates. A tie-beam supports the ceiling and is connected to the rafters through slim vertical struts (no connection rafter/tie-beam at wall-head). In the North section the wall-plates are not visible. The timbers are numbered with big sawn roman numerals but there are also some unusual carpentry marks.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 16 | B: 7 | Or Purlin - H: | B:

Timber elements' Dressing: civil (machine-sawn), rustic (hand-axed), rustic | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafter's apex: mortice and tenon with timber peg not flush. Between rafter and collar: lapped, sometimes dovetail, chamfered with metal nail.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description:

Not in sequence.

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints - dressing - carpentry marks | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features: Original plaster ceiling underneath

Unfavourable conditions: poor ventilation

Accessibility limitations: In one central part of the wing, the roof structure is not visible

Past interventions: Sarking replaced. Timbers in hip replaced. Some frames have been doubled (recently?) - only rafters.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

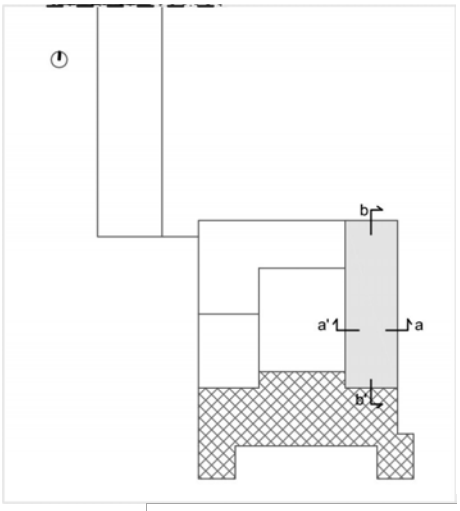
Estimated cause(s) of the primary damage: | link |

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link |

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link |

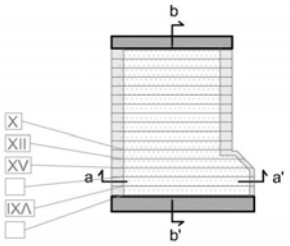


Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Legend (plans):

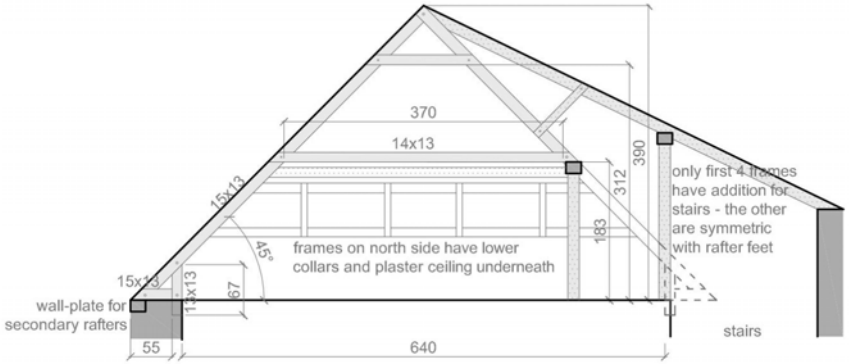
Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

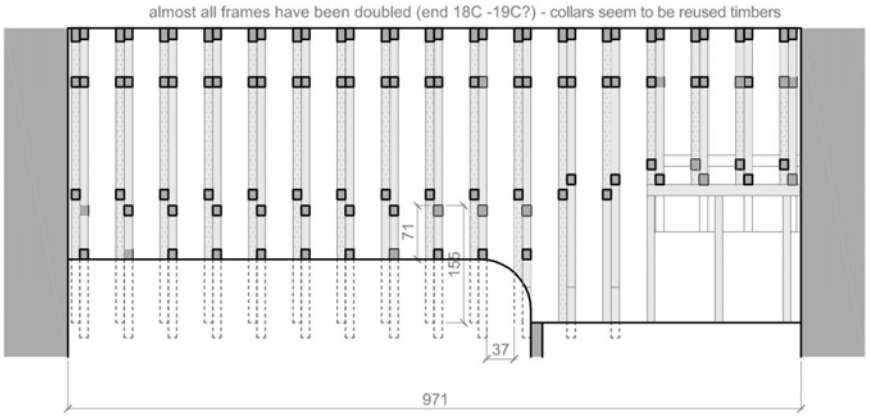
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** ROYSTON HOUSE | **Roof location** 1: W range

Survey date(s) 30/07/2015 | See drawing: RH-W-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.4 | Roof Height [m]: 3.9

Roof Pitch/es [°]: 45 | Roof Length [m]: 9.7

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.47

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1683 To 1696 | Identified by: Estimated

Roof General Description: Two-pitch gabled roof composed of 17 frames with two collars and rafter feet. Frames on North side have plaster ceiling underneath. Frames on South side have a later extension for staircase and remains of plaster on rafters and lower collars (it clearly used to be a room). Almost all frames have been doubled. All timbers are full logs roughly hand axed with some bark left on the corners.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 15 | B: 13 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg flush, Timber peg not flush

Joints description: Rafters' apex: mortice and tenon with timber peg not flush. Between rafters and collars: lapped with metal nail. In rafter foot all mortice and tenon with timber pegs flush.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Most of them are not visible, those which are visible are not in sequence.

Signs of reused timbers: Double collars seem to be reused timbers

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber elements' dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: original plaster ceiling under frames on north side

Unfavourable conditions:

Accessibility limitations: Frames on north side couldn't be closely inspected because of plaster ceiling underneath.

Past interventions: Double rafters and collars added (end 18C-19C?). Sarking replaced probably in the same period. Lower pitch on east side added later (19C?) to cover staircase.



Past interventions | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: link

Other Notes:

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber link

SAILOR'S WALK

Location: FIFE | KIRKCALDY AND DYSART

X coordinate: 328446 Y coordinate: 692059

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC

Protection status: NATIONAL

HS Listing: A Rcahms ID: 94225

Original Use: Residential

Current Use: Not in use

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1670	1679	BASED UPON STYLISTIC DETAILS - INCORPORATING EARLIER 15TH CENTURY FABRIC	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1954	1959		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2000		DATE NOT SURE	JOHN ADDISON

People involved:

Last Name	First Name	Role	Attributed
ADDISON	JOHN	ENGINEER	☐

Intervention type:	From:	To:	Description:	Reference:
SURVEY	2006			NTS

People involved:

Last Name	First Name	Role	Attributed
ADDYMAN ARCHAEOLOGY		ARCHAEOLOGIST	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
ADDYMAN ARCHAEOLOGY	2006	☑	SAILOR'S WALK, 443-449 HIGHT STREET, KIRKCALDY, FIFE - ANALYTIC ASSESSMENT AND HISTORIC BUILDING SURVEY FOR THE NATIONAL T SCOTLAND	
GIFFORD J.	1988	☐	THE BUILDINGS OF SCOTLAND COLLECTION: FIFE	
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	15

ARCHIVAL REFERENCES

Archive: Royal Commission on the Ancient and Historical Monuments of Scotland Doc.Num.: FID/114/2 Folios:

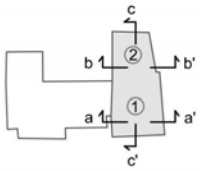
Title: Elevations: front and back; East elevation and sections (also adjoining cottages), Sailor's Walk, Kircaldy Insc. W. Williamson and Hubbard

Suggestions for further research:

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

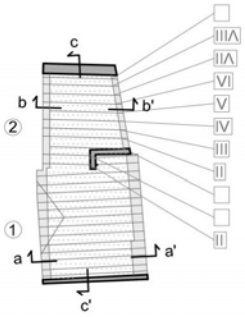
Archive	Royal Commission on the Ancient a	Doc. Num.	FID/114/2	Folios	
Title	Elevations: front and back; East elevation and sections (also adjoining cottages), Sailor's Walk, Kircaldy Insc. W. Williamson and Hubbard	Date: from	1935	to	
Contents					
Summary and comments					



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

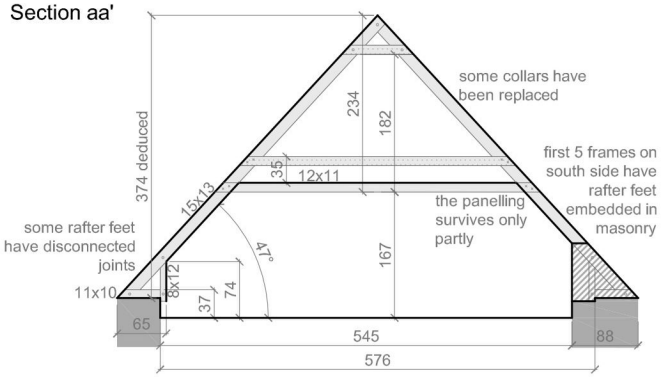
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



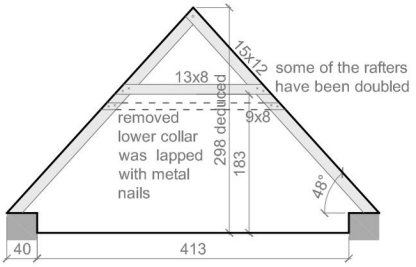
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'



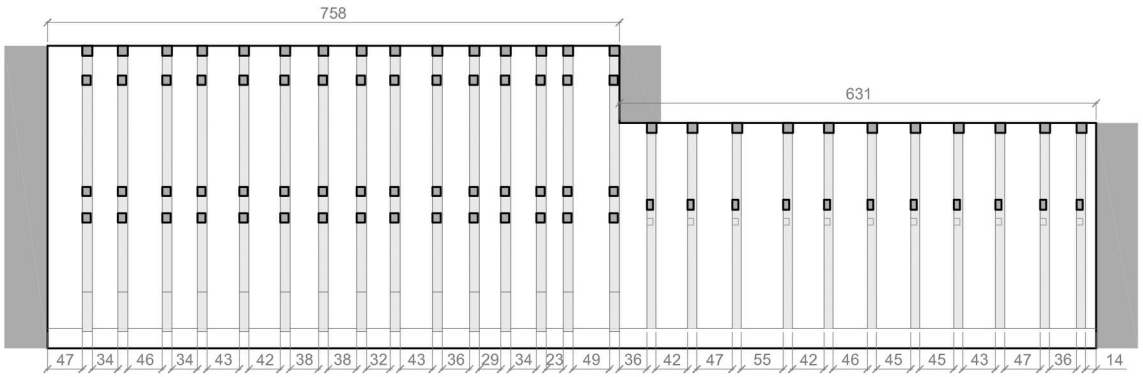
Section bb'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section cc'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** SAILOR'S WALK | **Roof location** 2: E range

Survey date(s) 11/09/2014 | See drawing: SW-E-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 4.13 | Roof Height [m]: 2.98

Roof Pitch/es [°]: 48 | Roof Length [m]: 6.3

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: None

Connection with gables:

Roof Construction Period: From 1670 To 1679 Identified by: Estimated

Roof General Description:

Building dated to 1670s based on stylistic considerations. The East range is the only one that could be surveyed; it has a two-pitch gabled roof, divided in two parts. The North section is composed of closely spaced rafter couples connected trasversally by one collar in and longitudinally by sarking boards only. The rafters simply sit on the wall-head. The timbers are all full logs roughly hand axed and numbered with big sawn roman numerals and unusual carpentry marks.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Round, Square with wanes

Rafter Scantling [cm] H: 15 B: 12 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) Bark ☐

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: mortice and tenon with timber peg. Between rafters and collar: half lapped with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description:

Roman numerals in sequence: visible ones go from II to VIII from south to north

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Dressing and carpentry marks link I:\Arch\A



Joints: rafter and collar link I:\Arch\A



Joints: rafter and original collar link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Some sarking replaced. Most rafters' ends strengthened with additional timber elements and a couple of frames have additional medium collars. Most lower collars doubled, some upper collars replaced. Some rafters doubled.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Insect attack in rafters, not sure if active



Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

INITIAL SURVEY | **Building name** SAILOR'S WALK | **Roof location** 1: E range

Survey date(s) 11/09/2014 | See drawing: SW-E-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.76 | Roof Height [m]: 3.74

Roof Pitch/es [°]: 47 | Roof Length [m]: 7.6

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1670 To 1679 | Identified by: Estimated

Roof General Description:

Building dated to 1670s based on stylistic considerations. The East range is the only one that could be surveyed; it has a two-pitch gabled roof, divided in two parts. The South section is composed of closely spaced rafter couples connected trasversally by three collars (two added later) and longitudinally by sarking boards only. The connection with the wall is provided by rafter feet partly embedded in masonry. The timbers are all full logs roughly hand axed and numbered with big sawn roman numerals. On the West side there is an intersecting roof. Part of painted timber panelling remains attached to rafters and lower collars

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Round, Square with wanes

Rafter Scantling [cm] H: 15 | B: 13 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg flush

Joints description:

Rafters' apex: mortice and tenon with timber peg. Between rafters and upper collar: half lapped with timber peg. Between rafters and lower collar: half lapped with metal nails. In rafter feet arrangement all mortice and tenon with timber pegs flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure: south | link I:\Arch\A



Roof Structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features: Part of painted timber panelling attached to rafters and lower collars

Unfavourable conditions:

Accessibility limitations:

Past interventions: Some sarking replaced. Most rafters' ends strengthened with additional timber elements and a couple of frames have additional medium collars. Most lower collars doubled, some upper collars replaced. Some rafters doubled.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Insect attack in rafters, not sure if active



Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage	Disconnection	Active	



Damage: disconnections | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☑
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: Almost all the mortice and tenon joints of the ashlar posts are opening.

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link | I:\Arch\A

STIRLING TOLBOOTH

Location: STIRLING | STIRLING
X coordinate: 279307 Y coordinate: 693696
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: A Rcahms ID: 46229

Original Use: City Council
Current Use: City Council, Theatre

Freestanding ☐ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1400	1499		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
RECONSTRUCTION	1703	1705		BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT	☐
CHRISTIE	JOHN	WRIGHT	☐
LIVINGSTONE	HARRY	MASTER MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1785		3 BAYS EAST	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
GRAY	GIDEON	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1808	1810	COURT HOUSE	

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1999	2001		BUILDINGS OF SCOTLAND COLLECTION

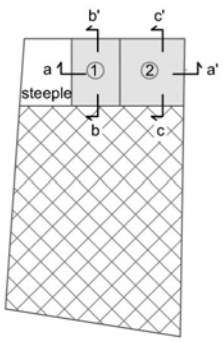
People involved:

Last Name	First Name	Role	Attributed
SIMPSON & BROWN		ARCHITECT	☐

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	120
GIFFORD J.	2002	☐	THE BUILDINGS OF SCOTLAND COLLECTION: STIRLING AND CENTRAL	
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	19

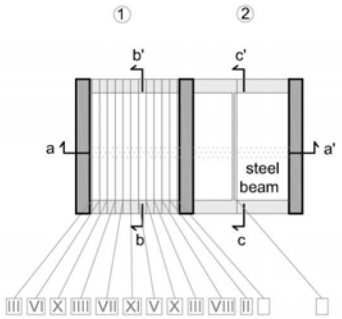
Suggestions for further research: NRS: miscellaneous papers 1710/39 (GD112/17/1/10)



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

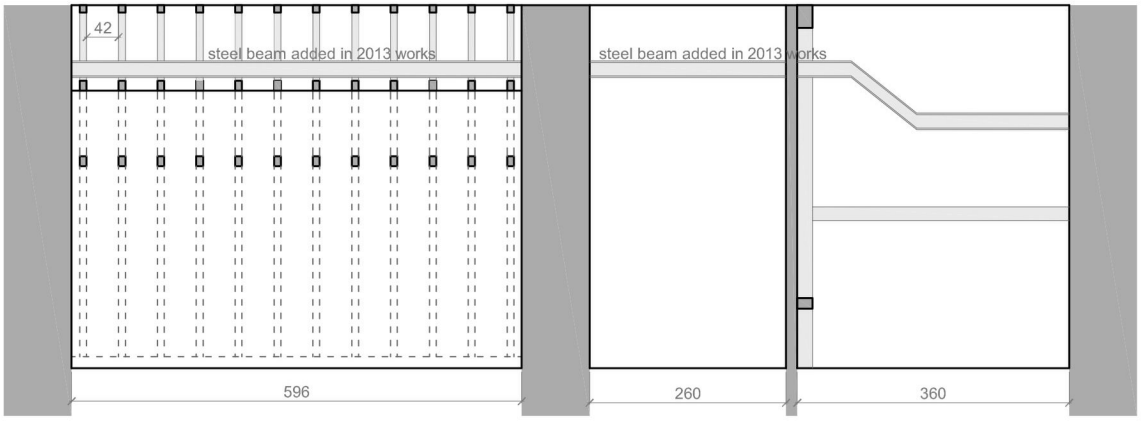
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

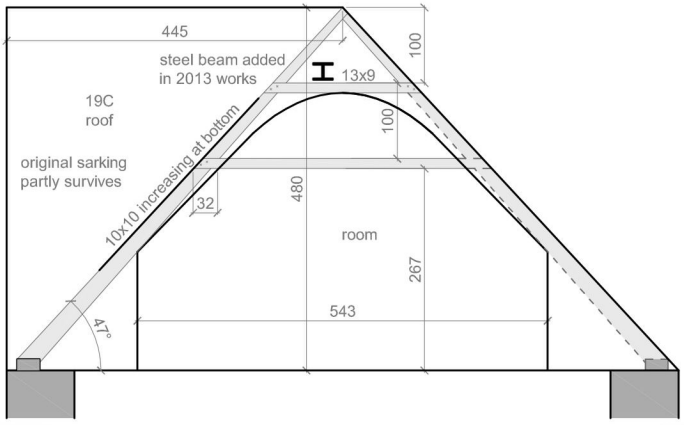
Section aa': ROOF ① and ②



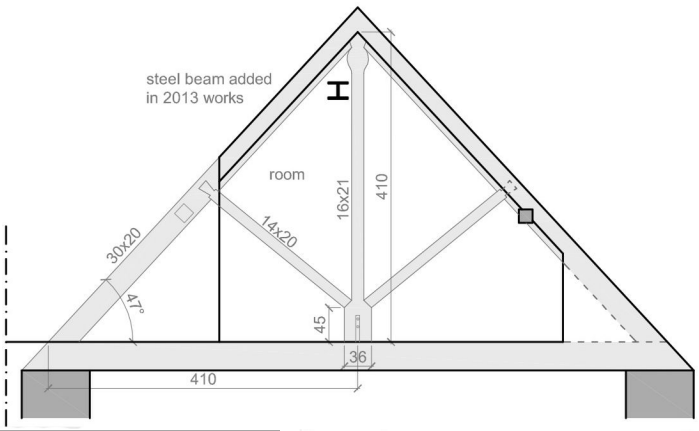
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb': ROOF ①



Section cc': ROOF ②



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** STIRLING TOLBOOTH | **Roof location** 2: E extension

Survey date(s) 30/09/2014 | See drawing: ST-E-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 8.2 | Roof Height [m]: 4.4

Roof Pitch/es [°]: 44 | Roof Length [m]: 3.6

Type of Primary Structure: 2D framing

Truss ☑ KING-POST

Frame ☐

Average Distance in between Primary Structure [m]: 3.5

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1785 To | Identified by: Estimated

Roof General Description:

Two-pitch gabled roof divided in two parts. The West section is supported by a king-post truss with one butt-purlin on each side and probably common rafters (they are not visible because they are behind the plaster, the roof space is used as office). A slanted strut on each side of the king post supports the rafters. The timbers are well dressed, hand sawn.

Roofing Material: slate

Roofing Material Fixing: Unknown

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 30 B: 20 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: bulb shaped joggle, dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal strap

Joints description:

Rafters apex: mortice and tenon with rounded joggle; between struts and king-post: mortice and tenon with joggles; between struts and rafters dovetail notched. Fasteners not visible, except for metal strap at bottom of post.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description: Not visible

Signs of reused timbers:

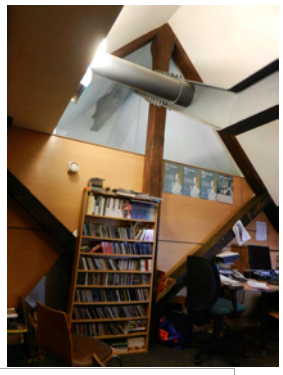
Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Joints: rafters apex | link I:\Arch\A



Joints: rafter and strut | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Secondary structure only partly visible. Connection with wall not visible.

Past interventions: Steel beam recently inserted beside the king-post. Purlin cut on south side.



Past interventions link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:		link
Roof Damage					
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes: Not clear what the is the structural funtcion of the new steel beam

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui link

INITIAL SURVEY | **Building name** STIRLING TOLBOOTH | **Roof location** 1: E range

Survey date(s) 30/09/2014 | See drawing: ST-E-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 8.2 | Roof Height [m]: 4.4

Roof Pitch/es [°]: 47 | Roof Length [m]: 5.96

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables:

Roof Construction Period: From 1703 To 1705 | Identified by: Estimated

Roof General Description: Two-pitch gabled roof divided in two parts. The East section is supported by closely spaced rafter couples connected transversally by two collars and longitudinally by sarking boards only. Not much of the structure is visible since the spaced is plastered and used as office. A steel beam has been inserted in the upper part of the roof.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes, Square with wanes

Rafter Scantling [cm] H: 10 | B: 10 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: lapped

Fasteners Types: Metal nail

Joints description: Rafters' apex's not visible. Joints between rafter and collars: lapped with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Not in sequence, probably because they have been moved and jointed to the new rafters

Signs of reused timbers: One of the lower collars has a redundant joint

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourablec onditions

Accessibility limitations: Structure not visible on north side

Past interventions: Rafters doubled, and some upper collars too, maybe in 19C when extensions were made to south. Original collars moved and jointed to the new rafters. Insulation and new plasterboards recently added. Steel beam recently inserted above the upper collar.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☐

Humidity stains on sarking and rafters



Humidity stains | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes: Not clear what the is the structural funtcion of the new steel beam

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

TWEEDDALE HOUSE

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)
X coordinate: 326123 Y coordinate: 673633
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Protection status: NATIONAL
HS Listing: B Rcahms ID: 262755

Original Use: Residential
Current Use: Offices, Residential

Freestanding ☐ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1576		DATE ON A DOOR INSIDE THE ORIGINAL N HOUSE WALL	HS

People involved:

Last Name	First Name	Role	Attributed
LAING	NEIL	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1595	1605	CONVERTED TO A DOUBLE PILE BY EXTENDING TO THE N	HS

People involved:

Last Name	First Name	Role	Attributed
LAING	JOHN	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1664		HS SAYS "RECAST"	HS

People involved:

Last Name	First Name	Role	Attributed
BRUCE	SIR WILLIAM	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1671	1674	EXTENSIVE REPAIRS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BAINE	JAMES	MATERIAL SUPPLIER, PLASTERER, WRIGHT	☐
HOOMS	GEORGE	MASON	☐
HAY	JOHN 1ST MARQUES	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1687		RECAST	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
HARRWAY	JOHN	MASON	☐
HAY	ALEXANDER	WRIGHT	☐
HAY	JOHN 1ST MARQUES	COMMISSIONERPATRON	☑

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1692	1693	MASON WORK, SEE YESTER PAPERS	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1742	1749	REPAIRS	NLS MS 14551

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☐
NEILSON	SAMUEL	MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1750	1756	HEAVILY REPAIRED - THE ROOF WAS REDONE COMPLETELY	NLS MS 14665 F. 64

People involved:

Last Name	First Name	Role	Attributed

HAY	JOHN 4TH MARQUES		☐
ADAM	JOHN	ARCHITECT	☐
MACK	CHARLES	MASON	☐
DUNLOP	THOMAS	CONTRACTOR, WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1783		FIVE-STOREY TENEMENT TO EAST	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
BRODIE	WILLIAM	WRIGHT	☐
BUTTER	WILLIAM	WRIGHT	☐
GILES	ARTHUR	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1791	1807	ROMAN DORIC PORCH WAS ADDED AND THE BUILDING EXTENDED TO THE W, INTERIORS ALTERED TO CREATE LARGER WORKSHOPS	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1800		ROOF ABOVE OTHER ONE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	205

ARCHIVAL REFERENCES

Archive	National Library of Scotland	Doc.Num.	MS 14665	Folios	64
Title	Account of work by Thomas Dunlop for the Marquis of Tweeddale 1756				
Archive	National Library of Scotland	Doc.Num.	MS 14680	Folios	
Title	Works at Tweedale House				
Archive	National Library of Scotland	Doc.Num.	MS 14637	Folios	73
Title	Account of timber work for the Earl of Tweeddale by James Baine				
Archive	Royal Commission on the Ancient and Historical Monuments of Scotland	Doc.Num.	DC 3496	Folios	
Title	Tweeddale Court, 14 High Street, Edinburgh -Section A-A				
Archive	Private: Tweeddale House	Doc.Num.	Uncatalogued	Folios	
Title	Drawings and pictures of survey and repair works carried out in 1980s at Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	109
Title	Contract between William Adam and the Marquis of Tweeddale for works at Yester House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	115
Title	Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	116
Title	Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	126
Title	Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	128
Title	Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	130

Title	Account of repairs done by John Adam probably at Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	137
Title	Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House				
Archive	National Library of Scotland	Doc.Num.	MS 14665	Folios	70
Title	Account of work by Thomas Dunlop for the Marquis of Tweeddale				
Archive	National Library of Scotland	Doc.Num.	MS 14665	Folios	69
Title	Account of work by Thomas Dunlop for the Marquis of Tweeddale				
Archive	National Library of Scotland	Doc.Num.	MS 14665	Folios	
Title	Account of work by Thomas Dunlop and timber from William Caddell for the Marquis of Tweeddale				
Archive	National Library of Scotland	Doc.Num.	MS 14637	Folios	67
Title	Account of work by James Baine at a stable in Edinburgh and one in Yester for the Marquis of Tweeddale				

Suggestions for further research	

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive National Library of Scotland Doc. Num. MS 14665 Folios 64

Title Account of work by Thomas Dunlop for the Marquis of Tweeddale 1756 Date: from to

Contents (outside - partly missing) *Accompt The Most Hon.ble The Marquis of Tweddale To Tho.s Dunlop wright for work done [...] 1754 [...] 160:7:10 1756*
at the House in Ed[...] Paid from the Year [...] 1750 to 1756 for [...] Repairs to Tweeddale House in Edinburgh [...] to Deacon Dunlop Carp[...] as instructed by the ???[...] accompt amounting to [...]
£ 540 - carpenters acct
£ 577 - masons acct

£ 1117 exclusive of slaters [...] smyth glazier and [...] painters accts & [...] an acct paid to mr adam [...] of upwards of £ 100 for [...] marble chimneis jambs and slabs
(inside) *The Most Honourable the Marquise of Twaddale 1750 to Thomas dunlop wright*
transporting furniture from the *Abbay*, double and single flooring with plansher nails and door nails, furniture, closing window, lining window, taking down lining/shelves/partitions, taking out books from library
[...] *to 5 days work of 6 men taking down the roof of the towr & stair ??? as ned it fall £ 1.15*
to 4 days work of 4 men taking of the roof of the south side of the house al Do per day £ 0.18.8
to 4 men 5 days seporting the south side of the house al Do per day £ 1.3.4
to 4 men 4 days taking of the roof of the north side al Do per day £ 0.18.8
to 3 days of 4 men al Do seporting Do £ 0.14 [...] lining, plaster lime to point the walls
[...] *to 16 hutts? Do [of plaister lime] & 4 clifts of dals with 100 naills furnished for mending the plaster of the* [...]
deals used for furniture (presses and closets) and for windows
mending plaster in various rooms
[...] *to 12 clifts of sawen dals with 500 plansher naills & o hutts plaster lime with 3 days work of 3 men putting up scaffolding to mend the plaster & lath at the back of Lord Charles room and room below Do £ 1.8.8*
[...] cutting the floors and *making borders for 3 rooms*, *boxing the hearth stone*, mending panels in rooms, cheeks for *skie lights* [...]
to 6 long dals furnished for mending the sarking of that roof 660 double flooring & 4 days work of two men £ 3.6.9
[...] mending the attic floors [...]
to taking of the landrie roof £ 0.3
to 2 days of 3 men putting one Do roof £ 0.7
to 32 cutts of sawn trees at 8 foot long for the roof 294 garron naills £ 1.9.10
to 6 single trees for backs to the couples 64 garron naills 3 days of two men for pa?ing and nailling Do £ 1.9
to 46 thick dals for casing and sarking and tyle lath & filliting £ 3.9
[...] tresses for the masons [...]
to 3 double trees & 10 dals for the roof at the back of the kitchen 12 garron nalls & 160 double flooring 2 days of 2 men £ 1.9.3
to 120 dals for scaffolding to the masons of which 15 of Do broke? & 20 trees & 6 of Do trees cutt 160 garron naills 1060 double floorings 300 double double & 8 days work of two men making and altering the scaffolding & ganys?
£ 4.9
[...] toubs and barrows for masons, deals for spouts, partitions, gantries, tables [...]
to 6 days of 4 men taking down the old houses & carrying Do to the backside £ 1.8
[...] elm and walnut trees used for furniture with glued (*gleu*) nails, cleaning rubbish [...]
to 457 yds 7 foot of rooffing and sarking one maine body of the house at 5pr yd £ 112.18.10 1/3
to 70 yds 5 foot one the to fall at 3pr yd £ 10.11
to 12 yds one the platform at 4pr yd £ 2.8
to 7 yds 4 ft one the east nefseray house £ 0.18.73
[...] whole deals or swn deals for lining (panelling?), naked flooring (only structure?), folding doors, *making a frame for carrying a fine screen to yester*, gate, dighting the floors, locks to doors, casway laying, cash for measurer
tot £ 505.10.6
deduct for old wood £ 5
plus other account £ 547.04.3
house rents to be deducted £19.12.2

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14637 Folios 67

Title Account of work by James Baine at a stable in Edinburgh and one in Yester for the Marquis of Tweeddale Date: from 1669 to

Contents (one side) *1669 ane acoumpt of furnitoe and workmanship for ane stable to the Earle of Tweddall at Edr furnished be James Baine wright and ane stabl at yestere*
Item in the ??? copalis & 16 ??? treis for syds and ??? per pair at 1£ 04s. £ 84

[Kate N. says *copalis* may be roofing couples]
Item for carting of tree caring of the ??? treis from leith 16 per pair at 3s. £ 10.04
Item for ??? ??? singl treis for barbs and hinging ??? per pair ??? ??? carting 12 £ 22.16
Item for ??? ??? twa treis for yester? 16? per pair ??? £ 48
Item for ten treis for stanards? and ??? for the stable per pair ??? £ 15
Item for hom? carting ??? ??? treis is £ 1.1
Item for twa sallentris? and on for the for syd of ??? pris per pair w.t hom? carting and salling 1.28 £ 5.08
Item for four treis for warping the partichand wall is £ 6
Item for ??? lintalls is £ 4
Item for the great dorman treis with the stanards? for the cath dore head £ 20
Item for four hunder and theitie ??? daills is at per 100 48 £ 192
Item for twa hunder of other daills per 100 at £40 £ 80
Item for carting of ??? hunder and theitie ancht? daills £ 15
Item for tria hunder and theitie singl garam nells is at per pair at 6d. £ 3.75
Item for ancht thousand 8 hunder of floring nells is per hunder at 12 £ 52.76
Item for twa dors w.t ther locks and bands is £ 7
Item for laying of the cassis £ 14
Item for caring away the rubesh £ 54
Item for caring away the rubesh out of the stables and ordering the rubesh about the dors is £ 5
Item for the maission work and furnishing lyme and sand is £ 300
Item for seavine thousand sllats being yor 1000 w.t the ??? carting £44 £ 308
Item for seavin thousand fyv hunder sllat nells per hunder is at 12 £ 45
Item for lym and sand for sllating is £ 20
tot £ 1312.09
(other side) *Item for the sllater worke is ane hunder and fortie marks £ 93*
Item ????????????
Receipt from James Baine. Received the sum of one thousand nine hundred and 25 pound scots money and seven shillings. Full payment for workmanship and furnishing of one stable and coach house at Edinburgh and repairing of one stable at Yester. 22 June 1669. James Baine

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14637 Folios 73

Title Account of timber work for the Earl of Tweeddale by James Baine Date: from 1675 to 1684

Contents
1675 one account ???? be? the Earl of Tweeddale to James Baine wright for timber and slates
Four daills for mending the C?? shop?
?One hndred floorin gnails
One man at that time for …?

8 febr 1676 two boxes for carrying of two looking glasses
Half a hundred plancher nails for rafter work in the Lodging
Two boxes for carrying of ??? to London

1677 for two chimney pieces
Two door ? pieces
Seven daills for ?? in the yard
??
One hundred of flooring nails
For work at that time
For the lining of two windows and one chimney port of the east end of the Low hall
One case and broads [shutters] *to the kitchen window*
1678 One coumed frame for the coffering/enclosing? The head of one bed one Coothead at the ??
4000 blue slates
??800 blue slates
Half a daill for filling/fitting to the slater
One hundred of Drunton (Trondheim) daills
1679 Two hundred and fifteen drunton daills
1680 Pinky?? 1200 slates
1681 1500 slates
1681 1800 slates

One account to my Lord Yester
Item 3000 blue slates
Forty four brod ??? daills
900 blue slates
Six merchant daills
26 daills for Pinky?

Reverse:
Comments and summary of payment made to James Baine by Tweeddale 1684

Summary and comments

Archive: National Library of Scotland | Doc. Num.: MS 14665 | Folios:

Title: Account of work by Thomas Dunlop and timber from William Caddell for the Marquis of Tweeddale | Date: from 1735 to 1753

Contents:
f. ??
january to september 1750 William Cadell merchant in Haddington
tot £ 42 for dealls with different prices
f. ??
march to november 1751 William Cadell merchant in Haddington
tot £ 93 for dealls with different prices, logs, iron bars, double trees, oak clapboards, wainscot 1/2 thick planks, scaillie
f. ??
april to november 1753 William Cadell merchant in Haddington
tot £ 56 for dealls with different prices, scaillie, logs, sawing
f. ??
1735 account to Thomas Dunlop
f. ??
1739 account to Thomas Dunlop

Summary and comments

Archive: National Library of Scotland | Doc. Num.: MS 14551 | Folios: 109

Title: Contract between William Adam and the Marquis of Tweeddale for works at Yester House | Date: from 1742 to 1749

Contents:
Dr? The most Hon.ble Marques of Tweeddale to William Adam Architect for repairs done to his house in Edinburgh
Decem 28 1742 – October 31 1749
chimneys, plasterwork, pointing, lead, hewn pavement for servant attic, …
TOT £ 11.76

Summary and comments

Archive: National Library of Scotland | Doc. Num.: MS 14551 | Folios: 116

Title: Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House | Date: from 1750 to

Contents:
My Lord,
I take the liberty to send to your lord inclosed a sketch for the different storeys of a little new house to be built in place of the old one in Edinburgh. It is such as I dare say your lord will not find fault with, wither for the dimentions of the rooms, or for the outward size of the whole, being only 47 by 49 feet over walls. I think it is conveniently disposed of, to answer what your lord proposes, but I thought it was best to send the rough draught to undergo the marques and his wife's examination before doing good drawings. […]
John Adam
20 August 1750

Summary and comments

Archive: National Library of Scotland | Doc. Num.: MS 14551 | Folios: 115

Title: Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House | Date: from 1750 to

Contents:
[…] I also lookt at your lord's house with great attention, & can assure your lord it is in a very melancholy way. There is not one single thing within the doors of it that can be of use in the repairs, or can be allowd to stand as they are. ***The roof is so bad, that a new one must inevitably be put on next spring****, and the floors, ceilings, doors, sashes, shutters & every thing must be made new, so that nothing in the world would be saved but the walls. This I confess is something, but not so much as your lord is apt to imagine as there is not a room in the house that has a door or a window properly placed in it, so that by rights these should be slap't & in that case I were almost as good to build them new. But supposing that your lord could comport with these as they are, it is my sincere opinion from the large size of the present house that if your lord once puts hand to the repairs of it, it must turn out as dear as building a little house from the foundation. I hope your lord will forgive my liberty on this head. I have no other view in it the to forwarn your lord of the expense that inevitably will follow if the repairs are once begun to, that so your lord may judge wether you would incline to bestow it or not. I shall send by the carrier the plans of the house as they presently are & as it was proposed to be alter'd that your lord may consider them.*
John Adam
26 June 1750

Summary and comments

Archive: National Library of Scotland | Doc. Num.: MS 14551 | Folios: 130

Title: Account of repairs done by John Adam probably at Tweeddale House | Date: from 1750 to

Contents: Accounts for repairs in Edinburgh House Mr Adam £ 11.76 - 30th September 1750

Summary and comments

Archive: National Library of Scotland | Doc. Num.: MS 14665 | Folios: 69

Title: Account of work by Thomas Dunlop for the Marquis of Tweeddale | Date: from 1750 to 1753

Contents: (outside) *House rents of small houses in the marquiss of Tweeddale's Close in Edin.re on the Right Hande going down set by*

Deacon Dunlop Carpenter for 3 years frome 1750 to 1753 £ 20.13.6
(inside) *Accompt of chairg and dischairg betwext Charls Hay of Hopps Ed.re and Thomas Dunlop for the markous of Twaddelles houses in Ed.re from whotsonday 1750 to whatsonday 1753*
he takes rent from people living in the Marquess houses and does some repairs in them
Itt give out for warning away the tennants when the houses was to take down [….

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14551 Folios 128

Title Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House Date: from 1753 to

Contents *[…] the laundry in your lord's house in town is 20 foot long, 16 foot broad & 9 foot high. The dining room is 27 foot long, 20 foot broad & 11 feet high. The plaister work of your lord's house is now begun & Mr Dunlop promises that it shall meet with no interruption from the wrights but that every thing shall be ready for him in due time. The other part of the work comes pretty well on. […]*
7 June 1753
John Adam

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14551 Folios 126

Title Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House Date: from 1753 to

Contents *My lord,*
Soon after my brother & I return'd to Town from Yester, ***we went to your lord's house along with Mess.rs Mack and Dunlop, & concerted every thing with them on the spot, in terms of what your lord directed****, so that they are now going on.* ***We are also making out for them Memorandums of the several things with drawings of the particular parts so as they may committ no mistake****. But one thing occurred to us, as a considerable improvement , th's we would not adventure to do it without your lord's leave, & that is to turn the present entry door from the court to the hall into a window & to change the east window of the present latter meat room into the entry door, & then to take away the wall which divides between the latter meat room & the hall, so as to throw them into one; By this means the hall will get light at the west end, which at present it wants, & the draught of air from the door is not directly opposite to the new door of relief, to the low drawing room. […]* he talks about other walls that could me moved
John Adam
15 March 1753

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14551 Folios 137

Title Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House Date: from 1755 to

Contents *[…] I have made out directions in writing for Mr Dunlop & the other people that they may get every thing done directly & without confusion.* problems with stove that has been put up in the wrong position and smoke in the lord's room. the lord put "Mr Auchinleck's machine" to get rid of the smoke!
13th October 1755
John Adam

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14665 Folios 70

Title Account of work by Thomas Dunlop for the Marquis of Tweeddale Date: from 1755 to 1756

Contents (outside) *Accompt the most honorable the markous of twddall to Tho: Dunlop 1755-56 £ 41.13.1*
(inside) *Accompt the most honorable the merkous of Twdal to Thomas Dunlop sinc 16 octobr 1755 and sinc the accompt was given in str*
[...] tables, chairs, windows, doors, presses, plaster, beds, shelves - talks about stables[...]
Itt in the washing hous two tries and 6 long spars put up [...]
[...] *to coot the floor and rouff to let up the vent* [...]
lintels for windows, table for Mrs Martine [...]
Itt to 24 long deals 16 penc pr pice lead in the garret to lay lumber on with work and nails to nail them £ 1.14
Itt to two broad firr planks in the ??? and to make borders to the hampers £ 0.6
[...] mending the drawing room

Summary and comments

Archive National Library of Scotland Doc. Num. MS 14680 Folios

Title Works at Tweedale House Date: from 1779 to 1782

Contents

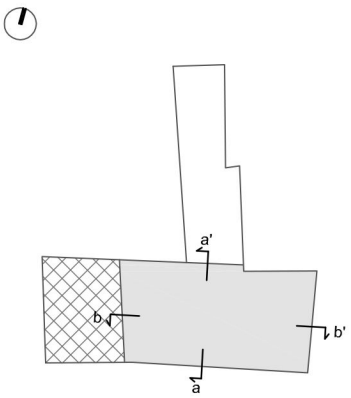
Summary and comments

Archive Private: Tweeddale House Doc. Num. Uncatalogued Folios

Title Drawings and pictures of survey and repair works carried out in 1980s at Tweeddale House Date: from 1980s to

Contents

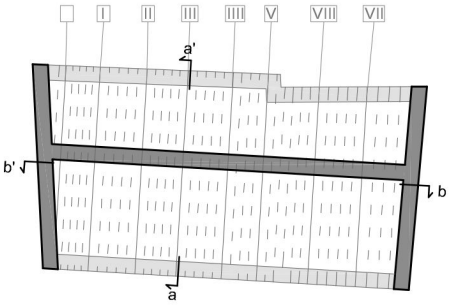
Summary and comments					
Archive	Royal Commission on the Ancient a	Doc. Num.	DC 3496	Folios	
Title	Tweeddale Court, 14 High Street, Edinburgh -Section A-A			Date: from	1984 to
Contents					
Summary and comments					



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

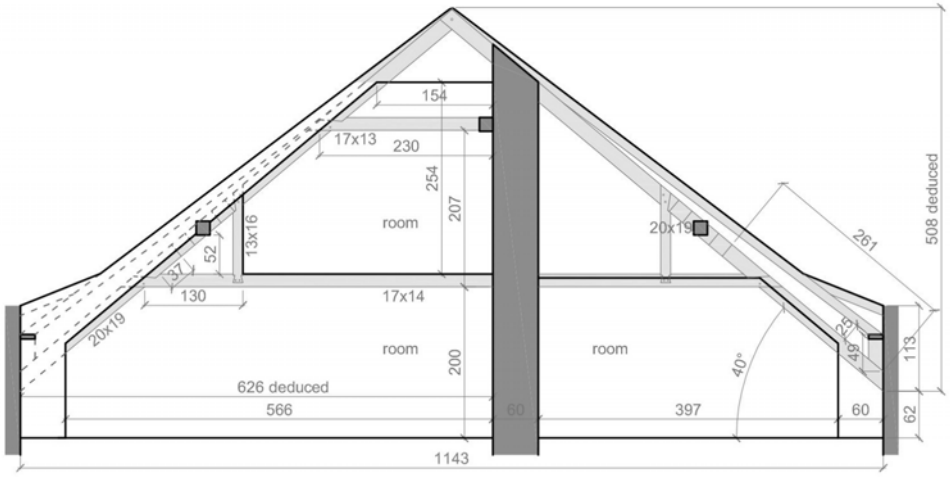
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

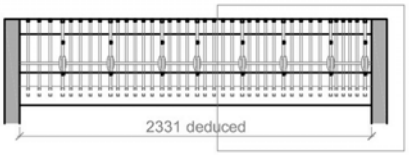
Section aa'

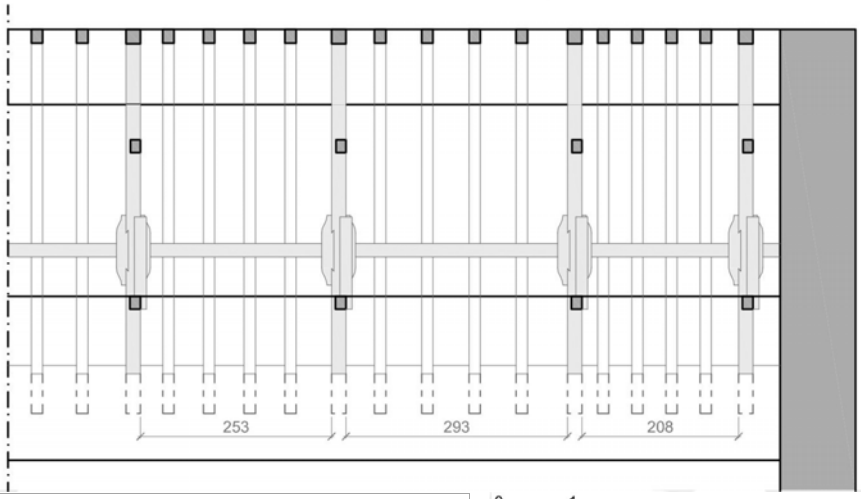


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** TWEEDDALE HOUSE | **Roof location** Main block

Survey date(s) 13/10/2014 | 11/12/2014 | See drawing: TWH-MB-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.26 | Roof Height [m]: 5.08

Roof Pitch/es [°]: 40 | Roof Length [m]: 23.3

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 2.2

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: None

Connection with gables: purlins

Roof Construction Period: From 1750 To 1756 Identified by: Estimated

Roof General Description:

House reroofed in 1750-6 and repairs done in 1779/82 and 1791. Two-pitch gabled roof supported by intermediate longitudinal wall. Frames divided in principal and secondary frames. One butt-purlin on each side connects the principal frames together. A vertical strut on each side connects rafters and lower collars. Original sarking was secured with timber pegs.

Roofing Material: slate

Roofing Material Fixing: Metal nails, Timber Pegs

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 20 B: 19 Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☑

Joint Types: cleat, dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg flush, Timber peg not flush

Joints description:

Rafters' apex not well visible, could be mortice and tenon or lapped with timber pegs flush. Between rafters and collars/struts: dovetail lapped with metal nails. Bwteen rafters and purlins: mortice and tenon with cleat and timber pegs not flush.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Mostly in sequence

Signs of reused timbers:

Some bark on collars, roughly shaped: they could be reused timbers from medieval roof. Archive documents record 5£ deducted from wrights' account for reused timber

Timber Treated ☐

Other Materials:

Few iron straps between collars and rafters. Steel bolts added in 1980s to reinforce cleats and purlins.

Dendrochronology:



Roof structure link I:\Arch\A



link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: strut and purlin link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall on south side not visible

Past interventions: Works in 1790s: rafters doubled with lower pitch; iron straps added between some collars and rafters. Works in 80s: some sarking replaced; some rafters and struts replaced partly or completely; hangers added; steel bolts added.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Insect attack on some collars, some looks old some new



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Material degradation | link | I:\Arch\A

Description of visible damage

Other Notes: Whilst purlins are normally employed in trussed roofs, cleats seem to be a more common feature in Italy, in both buildings and treatises.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link | I:\Arch\A

YESTER HOUSE

Location	EAST LOTHIAN		YESTER
X coordinate	354348	Y coordinate	667161
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PRIVATE		
Protection status	NATIONAL		
HS Listing	A	Rcahms ID	56117
Original Use	Residential		
Current Use	Residential		

Freestanding ☑ N. of floors above ground level 2 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1582		4 STOREYS TOWER-HOUSE CLOSE TO THE SITE WHERE THE PRESENT MANSION STANDS	DUNBAR 1972

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1600	1699	WINGS ADDED ON EACH SIDE OF TOWER-HOUSE	DUNBAR 1972

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1666	1669	WRIGHT WORK	CANMORE

People involved:

Last Name	First Name	Role	Attributed
SAMPSON	ROBERT	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION, LANDSCAPE	1670	1674	WRIGHT WORK INCLUDING FURNITURE + LAYING OUT OF THE PARK DESIGNED BY THE EARL	CANMORE

People involved:

Last Name	First Name	Role	Attributed
BAINE	JAMES	MATERIAL SUPPLIER, PLASTERER, WRIGHT	☐
MACKIE	CORNELIUS	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1686		JAMES SMITH PAID FOR FOUR STONE PEDESTALS FOR LEAD STATUES	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION, DEMOLITION, LANDSCAPE	1699	1715	NEW HOUSE CLOSE TO OLD ONE - OLD HOUSE WAS PROBABLY DEMOLISHED AROUND 1705	HS

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	ARCHITECT	☐
MCGILL	ALEXANDER	ARCHITECT	☐
RAE	DAVID	WRIGHT	☐
JOHNSTON	JOHN	WRIGHT	☐
BRUCE 1	SIR WILLIAM 1	ARCHITECT	☑
FINLAYSON	GEORGE	MASTER MASON	☐
SYME	JAMES	SLATER	☐

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1715	1728	CONSTRUCTION OF HOUSE CONTINUES	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
HAY	JOHN 4TH MARQUES	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1729	1748	NEW LEAD PLATFORM ROOF OVER DOUBLE-PITCHED SLATE ROOF. COLUMNS ADDED ON THE FACADES AND IMPOSING DOUBLE STAIRCASE TO ACCESS GROUND FLOOR + ADJUSTMENT OF FLOOR LEVELS	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT, MATERIAL SUPPLIER	☐
LOW	JOHN	OVERSEER	☐
ENZER	JOSEPH	PLASTERER	☐
NICOLS	FRANCIS	PLASTERER	☐
ROBERTSON	PHILLIP	PLASTERER	☐
NORIE	JAMES	PAINTER	☐
DOUGLAS	CHARLES	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION, LANDSCAPE	1750	1761	EAST PAVILION ALTERED TO PUT IN NURSERY - GARDENS ALTERED - LODGES AND GATEWAY TOWARDS GIFFORD VILLAGE - PLASTERWORK IN THE SALOON	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
HAY	GEORGE 7TH MARQ	COMMISSIONERPATRON	☐
ADAM	ROBERT	ARCHITECT	☐
ADAM 1	JAMES 1	ARCHITECT	☐
DAWSON	JOHN	PLASTERER	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1788	1790	APPROACH RAMP, DRAWING ROOM, FRONT AND REAR ELEVATIONS - ROOF ALTERATIONS TO INSERT WINDOWS FOR SALOON	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
ADAM	ROBERT	ARCHITECT	☐
HAY	GEORGE 7TH MARQ	COMMISSIONERPATRON	☐
HAY	JOHN	CONTRACTOR	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1793	1794	REPLASTERING THE STAIRCASE CUPOLAS + WRIGHT WORK IN UPPER DRAWING-ROOM AND ADJOINING ROOMS	DUNBAR 1972

People involved:

Last Name	First Name	Role	Attributed
DONALDSON	WILLIAM	WRIGHT	☐
RUSSELL	THOMAS	PLASTERER	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1797		WEST WING REPAIRED AFTER FIRE DAMAGE	DUNBAR 1972

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1830	1839	REMOVED W PAVILION AND ADDED NEW PORTE COCHERE TO W, TRANSFERRING ENTRANCE TO SIDE POSITION - INTERIOR REDECORATION.	HS

People involved:

Last Name	First Name	Role	Attributed
HAY	GEORGE 8TH MARQ	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1876	1878	ROOF AND CEILINGS	DUNBAR 1972

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	15

Author	Year	Unpubl.	Title	Pages
RYKWERT J.	1985	☐	THE BROTHERS ADAM. THE MEN AND THE STYLE	210
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 25-30
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	25-31

ARCHIVAL REFERENCES

Archive	National Library of Scotland	Doc.Num.	MS 14637	Folios	74
Title	Account of timber work at Yester House by James Baine				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	22
Title	Contract between William Adam and the Marquis of Tweeddale for works at Yester House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	24
Title	Contract between William Adam and the Marquis of Tweeddale for works at Yester House				
Archive	National Library of Scotland	Doc.Num.	MS 14551	Folios	112
Title	Account of timber furnished by William Adam for Yester House				
Archive	National Library of Scotland	Doc.Num.	MS 14637	Folios	66
Title	Account of work by James Baine for the Marquis of Tweeddale				
Archive	National Library of Scotland	Doc.Num.	MS 14637	Folios	67
Title	Account of work by James Baine at a stable in Edinburgh and one in Yester for the Marquis of Tweeddale				
Archive	National Library of Scotland	Doc.Num.	MS 14637	Folios	68
Title	Account of work at Yester				

Suggestions for further research: NLS: Hay papers

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive: National Library of Scotland | Doc. Num.: MS 14637 | Folios: 66

Title: Account of work by James Baine for the Marquis of Tweeddale | Date: from 1668 to

Contents:
(one side) *Comptt and rectt James Baine wright for ??? yester and pan cratch to ??? 9th 24tt ???*
(other side) 1668 May tot £ 24.18

Summary and comments:

Archive: National Library of Scotland | Doc. Num.: MS 14637 | Folios: 68

Title: Account of work at Yester | Date: from 1669 to

Contents:
Agust 1669 ane acoumpt of timber and workmanship for yester
Item for sixtaine? ockane treis is at ??????? £ 40.12
Item for ane long great tri that was 33 foot of length £ 12
Item for the sawing of that tri from the on end to the other £ 1.04
Item for ane other short great trie is at £ 4.7
Item for ane hunder and anchtie dalls at 8 per peic is £ 80
Item for ane other hunder of dalls is £ 48
Item for twentie sex ockane garrons is per peic £ 15.72
Item for twa wainscot per peic at ??? £ 9
Item for ancht double tris at per piec 7£ 4p. £ 9.72
Item for four scor [80] *of daills is at per peic 6p. 8s. £ 26.13.8*
Item for thri thousand sllat nells to yester is £ 18
Item to neidpeath? ane thousand floorings is £ 6
Item to neidpeath? ancht hunder of slating? nells is £ 4
John Baine, ???, James pitlour?, Hobert ???drack, John Waterspun, John Baine Younger
tot £ 1925.07

Summary and comments:

Archive: National Library of Scotland | Doc. Num.: MS 14637 | Folios: 67

Title: Account of work by James Baine at a stable in Edinburgh and one in Yester for the Marquis of Tweeddale | Date: from 1669 to

Contents:
(one side) *1669 ane acoumpt of furnitoe and workmanship for ane stable to the Earle of Tweddall at Edr furnished be James Baine wright and ane stabl at yestere*
Item in the ??? copalis & 16 ??? treis for syds and ??? per pair at 1£ 04s. £ 84
[Kate N. says *copalis* may be roofing couples]
Item for carting of tree caring of the ??? treis from leith 16 per pair at 3s. £ 10.04
Item for ??? ??? singl treis for barbs and hinging ??? per pair ??? ??? carting 12 £ 22.16
Item for ??? ??? twa treis for yester? 16? per pair ??? £ 48
Item for ten treis for stanards? and ??? for the stable per pair ??? £ 15
Item for hom? carting ??? ??? treis is £ 1.1
Item for twa sallentris? and on for the for syd of ??? pris per pair w.t hom? carting and salling 1.28 £ 5.08
Item for four treis for warping the partichand wall is £ 6
Item for ??? lintalls is £ 4
Item for the great dorman treis with the stanards? for the cath dore head £ 20
Item for four hunder and theitie ??? daills is at per 100 48 £ 192
Item for twa hunder of other daills per 100 at £40 £ 80
Item for carting of ??? hunder and theitie ancht? daills £ 15
Item for tria hunder and theitie singl garam nells is at per pair at 6d. £ 3.75
Item for ancht thousand 8 hunder of floring nells is per hunder at 12 £ 52.76
Item for twa dors w.t ther locks and bands is £ 7
Item for laying of the cassis £ 14
Item for caring away the rubesh £ 54
Item for caring away the rubesh out of the stables and ordering the rubesh about the dors is £ 5
Item for the maission work and furnishing lyme and sand is £ 300
Item for seavine thousand sllats being yor 1000 w.t the ??? carting £44 £ 308
Item for seavin thousand fyv hunder sllat nells per hunder is at 12 £ 45
Item for lym and sand for sllating is £ 20
tot £ 1312.09
(other side) *Item for the sllater worke is ane hunder and fortie marks £ 93*
Item ???????????
Receipt from James Baine. Received the sum of one thousand nine hundred and 25 pound scots money and seven shillings. Full

payment for workmanship and furnishing of one stable and coach house at Edinburgh and repairing of one stable at Yester. 22 June 1669. James Baine

Summary and comments

Archive National Library of Scotland | Doc. Num. MS 14637 | Folios 74

Title: Account of timber work at Yester House by James Baine | Date: from 1675 to

Contents:

Account the Earl of Tweeddale ??
James Bain His Majestys Master Wright..???? 1675

For four door ??? for mending the Cobbler his shop?
One deal for one tre????????
One hundred of flooring nails

For one man working of the above????
?????? in the house at Yester
For two boxes for carriage of looking glasses
Half one hundred of plancher nails
For two boxes for carrying of goods to London
For two chimney pieces with two frames above ??

Seven deals for boxing of the ??
??
One hundred of flooring nails
Work wrought at the???

For lining of two windows with one chimney piece in that chamber adjacent to the Laigh Hall ??
For one case with broads to the kitchen window
For one coumed/carved frame for the head of one ?
One coumed/carved head ?? in my Lords Chamber
1678 4000 blue slates ?
Per thousand ???? to James Murray
800 slates ??? with Musselburgh [Castle?]
???????
One hundred of drunton daills
Two hundred and fifteen drunton deallis
To Pinkie one thousand and two hundred slates
One thousand eight hundred and sixty slates
Att 44 pound per thousand??
20 May To yester? Three thousand blue slates ???
Forty four Christian (Oslo) deals??
?? hundred slates
Merchant? Deals
Six broad dealls

Summary and comments

Archive National Library of Scotland | Doc. Num. MS 14551 | Folios 22

Title: Contract between William Adam and the Marquis of Tweeddale for works at Yester House | Date: from 1729 to

Contents:

Edinburgh 20th December 1729 – contract between William Adam and the Marques of Tweeddale
the marquess of Tweeddale asks William Adam *architect in Edinburgh […] whereas the present roofe of Yester house being done after the forme commonly called a Happer roof which lodges a great quantity of snow in the winter season to the great prejudice of the said roofe And the said noble marques being designed to alter the same from a Happer roofe to a Plattform to lye betwixt the ridges of the present roof […] The east part of the said house all which to be said with sufficient* ***beams of firr wood*** *and* ***sarking deals*** *and to be* ***covered with lead*** *sufficiently cast and laid with the usual rolls and overlaps at eight pound weight each foot […] As also* ***the said noble marques designing to roofe*** *the middle part of the said house viz- that over the great hall and garden room bounded betwixt the forementioned two principall walls with a pediment roofe to be* ***covered with blue siaillie*** *Wherefore the said William Adam binds and obliges him his heirs executers and successors? to perform the foresaid articles of platt forming in beams sarking and lead, with the pediment roofe and siaillie work over the formentioned middle part of the said house in manner forsaid, and to furnish upon his own proper charges and expenses the whole material there to as also to reuse upon the*
signatures cancelled

Summary and comments

Archive National Library of Scotland | Doc. Num. MS 14551 | Folios 112

Title: Account of timber furnished by William Adam for Yester House | Date: from 1742 to 1748

Contents:

Account of W. Adam who **furnished timber to Yester House**
Oct 26 1742 – June 8 1748
TOT £ 113.2

Summary and comments

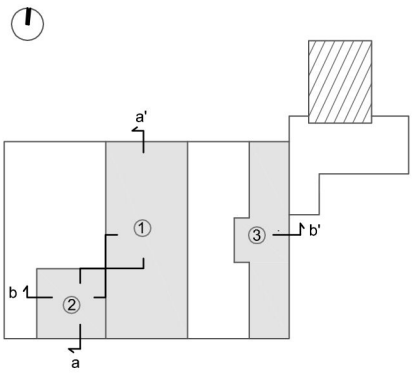
Archive National Library of Scotland | Doc. Num. MS 14551 | Folios 24

Title: Contract between William Adam and the Marquis of Tweeddale for works at Yester House | Date: from Undated to

Contents:

Another contract between the Marques and W. Adam
signatures cancelled
W. Adam is providing all the material: *all stons lyme and sand and to cause carry and lay down all lead and* ***timber from the port of portseaton*** *to the plane of yester and to lay down the same within the court at yester The said William Adam having the timber in readiness at the said port of portseaton so as may be ready to be carried to yester […] And is hereby declared that all the timber lead and siaillie now upon the house whilst? will or maybe altered by this new design shall be deemed the property of the said William Adam in so far as he shall*
The same in the alterations to be made on the present roofe but if any of the old timber lead and siaillie remains after the house is finished the same is to belong to the said noble marques And the said noble ***marques oblidges him to cut and squair two rows of the firr trees now growing in the garden from the cannall to the trongate and to furnish the same to the said William Adam for scaffolding*** **and for hand or horse machines that W. Adam might need to carry the materials to the top of the house**
they get some lead from the Duke of Queensbeery – W. Adam pays for it

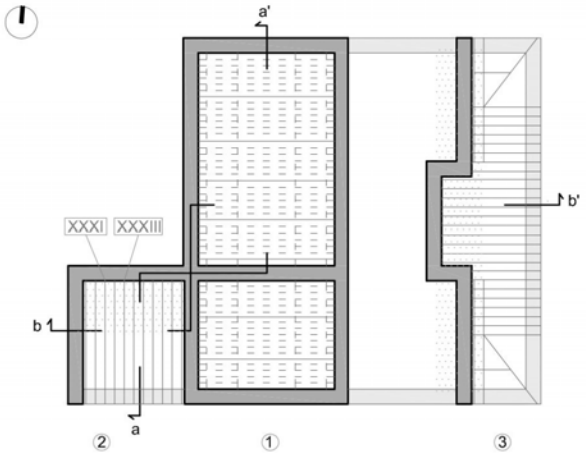
Summary and comments



Legend (plans):

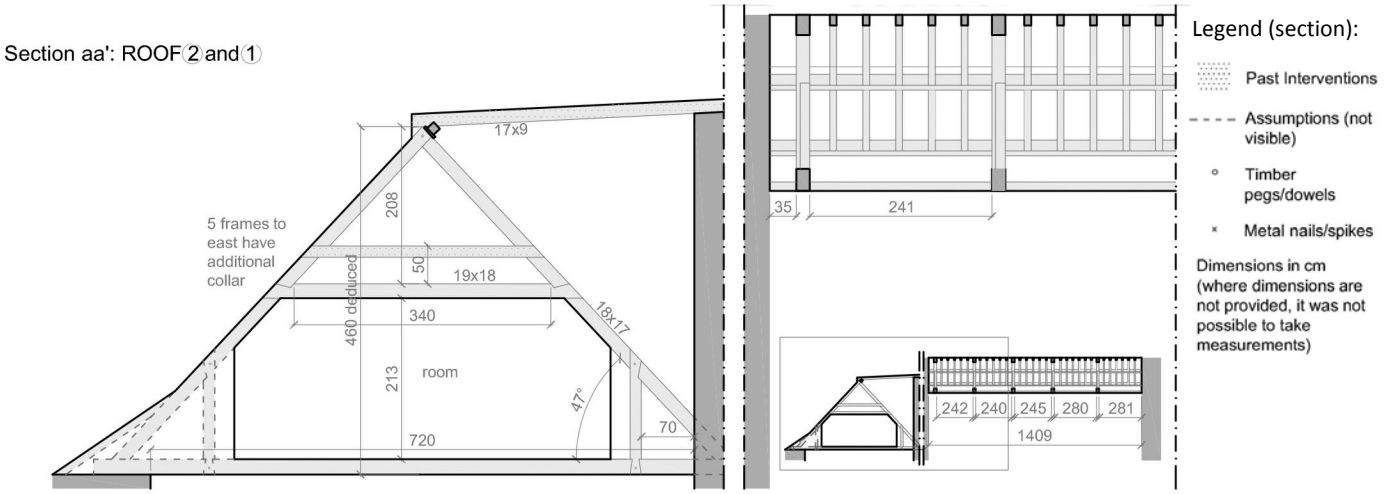
Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

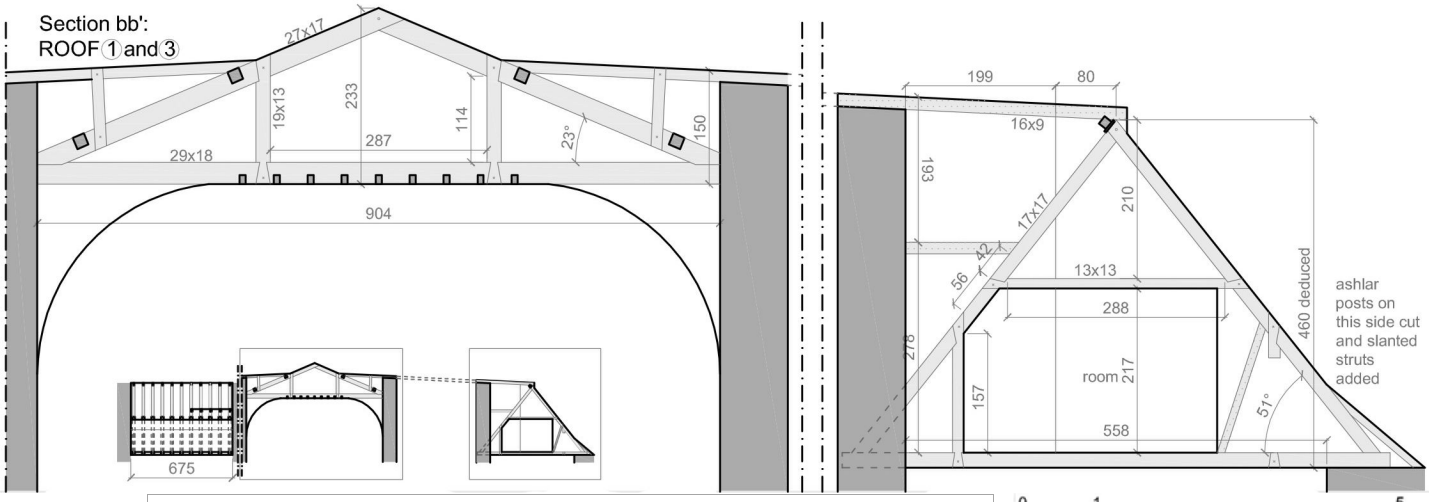
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



Roof 1 from outside I:\Arch\A



Roof 2 from outside I:\Arch\A

INITIAL SURVEY | **Building name** YESTER HOUSE | **Roof location** 3: E part of main block

Survey date(s) 26/08/2015 | See drawing: YH-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 5.6 | Roof Height [m]: 4.6

Roof Pitch/es [°]: 51 | Roof Length [m]:

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.52

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm]: | thickness [cm]: 3

Connection with lateral walls: Tie-beam

Connection with gables: rafters

Roof Construction Period: From 1699 To 1729 Identified by: Estimated

Roof General Description:

Late 17C gabled roof with simple frames with two collars transformed into a platform roof in early 18C. Ashlar post probably added when platform roof was put on top.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 16 B: 16 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: mortice and tenon with timber peg not flush. Between rafters and collars/struts: dovetail lapped (struts have metal nails, collar joints are not well visible).

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: runic marks

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Roof structure link I:\Arch\A



Timber dressing link I:\Arch\A



Joints: rafter and collar link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Some ashlar posts on east side cut and replaced with slanted struts



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains and fungi attack on sarking and rafters. Looks active.



Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Fungi attack | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** YESTER HOUSE | **Roof location** 2: SW part of main block

Survey date(s) 26/08/2015 | See drawing: YH-MB-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 7.2 | Roof Height [m]: 4.6

Roof Pitch/es [°]: 47 | Roof Length [m]: 6.7

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.5

Type of Secondary Structure: sarking | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Tie-beam

Connection with gables:

Roof Construction Period: From 1699 To 1729 | Identified by: Estimated

Roof General Description: Late 17C gabled roof with simple frames with two collars transformed into a platform roof in early 18C. Ashlar post probably added when platform roof was put on top.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes, Square with wanes

Rafter Scantling [cm] H: 18 | B: 17 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Rafters' apex: mortice and tenon with timber peg not flush. Between rafters and collars/struts: dovetail lapped (struts have metal nails, collar joints are not well visible).

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals, runic marks

Carpentry Marks Description: Only few visible

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall on south side not visible, and only partly visible on north side.

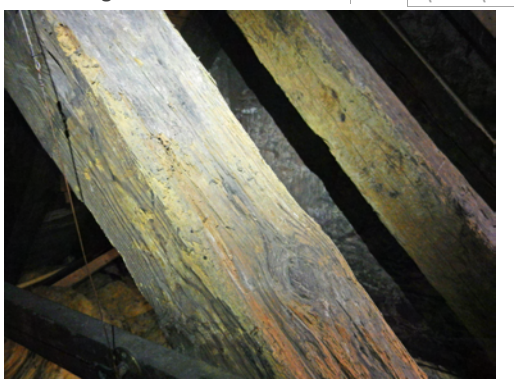
Past interventions: Some sarking replaced.



Material degradation | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Insect attack on rafters, not sure if active



Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage: | link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** YESTER HOUSE | **Roof location** 1: central part of main block

Survey date(s) 26/08/2015 | See drawing: YH-MB-1

Roof Geometry: Flat, Two-pitch gabled

Roof Max Span [m]: 9 | Roof Height [m]: 2.33

Roof Pitch/es [°]: 23 | Roof Length [m]: 22.3

Type of Primary Structure: 2D framing

Truss ☑ OTHER

Frame ☐ Struts

Average Distance in between Primary Structure [m]: 2.45

Type of Secondary Structure: common rafters, purlins, sa | Plane: roof plane

Sarking boards: width [cm] | thickness [cm]: 4

Connection with lateral walls: Tie-beam

Connection with gables: purlins

Roof Construction Period: From 1729 To 1748 | Identified by: Estimated

Roof General Description: Gabled roof supported by 7 trusses, each composed of a tie-beam, 2 rafters and two vertical struts. Two purlins on each side support the common rafters and the sarking. A lower pitch is added on the sides to link with the platform on the other sides.

Roofing Material: lead

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 27 | B: 17 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal nail, Timber peg flush

Joints description: Between rafters and tie-beam and at rafters' apex: mortice and tenon (rafters' apex also have timber peg flush). Struts are secured with dovetaill lapped joint with a metal nail.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: runic marks

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: tie-beam and strut | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features: Original plaster ceiling underneath

Unfavourable conditions: poor ventilation

Accessibility limitations:

Past interventions: Some common rafters replaced. Purlin end reinforced with steel plates and timber struts.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☐

Humidity stains in sarking and common rafters, insect attack in common rafters, not sure if active.



Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks	Unknown	
Connection Damage	Disconnection	Unknown	



Damage: opening of joints | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient joints
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: crack in rafter | link | I:\Arch\A

Description of visible damage: Joints between rafters and tie-beams are opening, as if the rafters were sliding outward. Not sure if movement is still active. One rafter on west side is cracked.

Other Notes:

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

APPENDIX F

STRUCTURED FORMS OF THE CASE STUDIES

COCKENZIE HOUSE.....719
HOLYROOD PALACE.....766
NEWHAILES HOUSE.....838
PINKIE HOUSE.....865
ST ANDREW'S & ST GEORGE'S CHURCH.....913
ST ANDREW'S IN THE SQUARE CHURCH.....930
STIRLING CASTLE.....946
TOUCH HOUSE.....1039

COCKENZIE HOUSE

Location: EAST LOTHIAN | TRANENT
X coordinate: 340022 Y coordinate: 675641
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Rcahms ID: 53644
HS Listing: A

Original Use: Residential
Current Use: Hospital

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1680	1683	MAYBE INCORPORATING EARLIER FABRIC	JOE ROCK

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	ARCHITECT	☐
SETON	GEORGE 4TH EARL O	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1700	1725	WAREHOUSE TO WEST	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1750	1799	PILASTERED PORCH AND OTHER	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1845	1902	TO THE NORTH FRONT	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION, DAMAGE	1980	1989	FIRE IN NORTH WING, WHICH HAD TO BE REROOFED	TENANTS

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
ROCK J.	2015	☑	COCKENZIE HOUSE - NEW RESEARCH	
WALKER D.	1976	☑	HISTORIC BUILDINGS REPORT	

ARCHIVAL REFERENCES

Archive: National Records of Scotland Doc.Num.: E661/107 Folios: 3, 6, 10 and 3 folios un-numbered

Title: Forfeited Estates: Winton: Estate papers and vouchers prior to forfeiture: Accounts for timber bought for the earl of Winton by David Balfour, his chamberlain, 1681

Suggestions for further research:

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive	National Records of Scotland	Doc. Num.	E661/107	Folios	3, 6, 10 and 3 folios un-numbered

Title: Forfeited Estates: Winton: Estate papers and vouchers prior to forfeiture: Accounts for timber bought for the earl of Winton by David Balfour, his chamberlain, 1681 — Date: from 1681 to

Contents

3
Leath 7th May 1681
Received from William Taitt carpinter in Leath upon the accompt of the Earle of Wintone ane? paire of wood of twentie two feets long and twelve inches squair bought be me att eyhtanie shillings per foots as also a paire of wood called a Knight [...]
D. Balfoure
Other merchants are paid: John Memeres?, Andrew Myrtime?, William Wilson, George Clark

6
Accompt & receat Normand Blaikson? 1681
40 single trees at 10s. per tree
four deals at 8s. per deal
20 single trees at 10s per tree
tot 41£

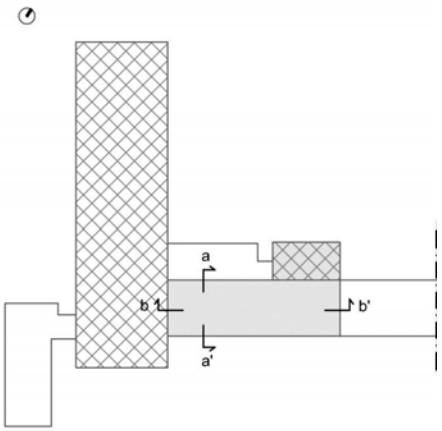
10
An accompt of timber received be James Steven wright from James Cockburn for the use of the Ealre of Wintons saltyarns in Cockenie & coall sinck ther, from the 19th of January 81 to the ???
12 double trees and 8 single trees for John Mathisons panroofe
1 double tree for Richard Bools Coop
many more double trees, and double doubles

no number
An accompt what timber Mr David Ballfour has gotten from Ja. Cockrane for my lord winton his use for the call work at tranent & the sinke at corkenny? lime our cast claying which was in april 23 ???
double trees
single trees
deals

no number
An accompt of what timber [missing] *recevid from James Cockburn by my lords order for the use of his gien? at tranent in No.br the 19 1680 a fokouth?*
3 double doubles
4 double trees
another double tree

no number
Accompt off timber receave be James Trotter? from James Cockburne for my lord winton ??? ??? ??? for Cokeney: sink and the coall works at tranente from the 24 jany 1681 to the 20 of Apryll ditto
double doubles
double tresses
single tress

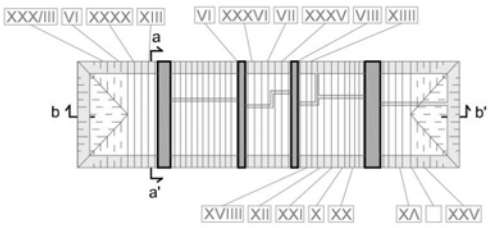
Summary and comments: 1681 timber bought by the Earl of Winton. Cockenzie and Tranent are mentioned, thus it could be timber used for Cockenzie House, but it is not sure.



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

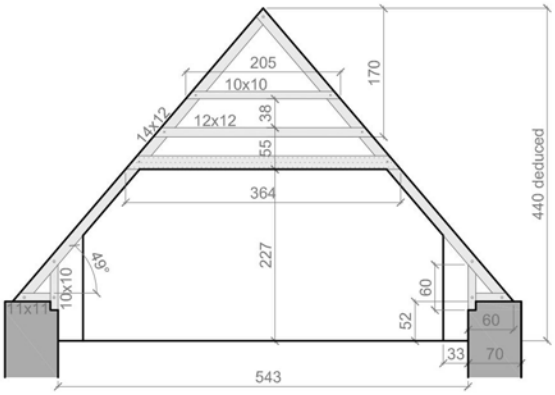
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

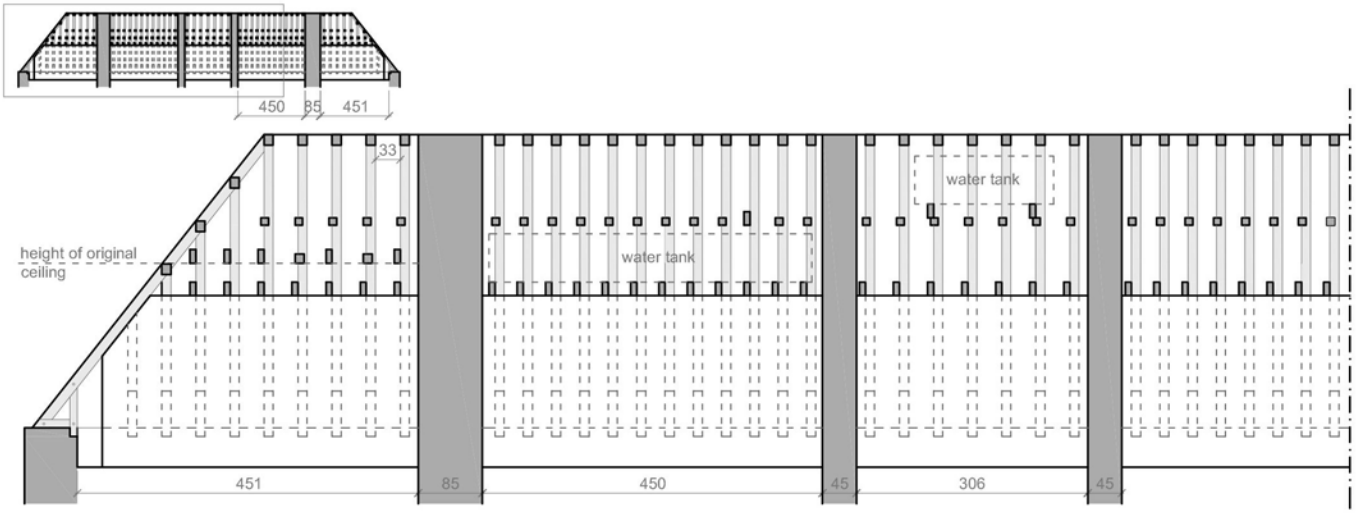
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** COCKENZIE HOUSE | **Roof location** E range

Survey date(s) 10/11/2015 | See drawing: COH-E-1

Roof Geometry: Hipped

Roof Max Span [m]: 5.43 | Roof Height [m]: 4.4

Roof Pitch/es [°]: 49 | Roof Length [m]: 23.7

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking

Sarking boards: width [cm] | thickness [cm]: 2

Connection with lateral walls: Rafter foot

Connection with gables: sarking interrupted (chimney)

Roof Construction Period: From 1680 To 1683 Identified by: Estimated

Roof General Description:

Hipped roof supported by simple frames with two collars and rafter feet with the ashlar post extended downwards on the masonry (visible only in a few points). Most of the lower collars have been removed and replaced at a lower height (the ceilings are in fact not original). All elements are full logs roughly squared with some bark retained. There are 4 intermediate gables: the external ones are thicker and house chimneys, thus the roof structure here is interrupted; the inner ones are thinner and more recent.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 14 B: 12 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg flush, Timber peg not flush

Joints description:

Rafters' apex: lapped with timber peg not flush. Between rafters and collars: lapped with hint of dovetail and metal nail. Rafter feet: mortice and tenon with timber pegs flush.

Wood Species:

All elements, including sarking and pegs securing the joints: pinus sylvestris

Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Not all elements have visible numbers and the visible ones are not in sequence

Signs of reused timbers:

Some redundant lap joints on collars.

Timber Treated ☑ in E part, probably for insects

Other Materials:

Dendrochronology:



Roof structure link I:\Arch\A



Connection with the wall link I:\Arch\A



Timber dressing link I:\Arch\A



Joint: collar and rafter link I:\Arch\A



Redundant joint & carpentry marks link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance, poor ventilation, presence of water tank

Accessibility limitations: The connection with the wall is visible only in two sections of the roof

Past interventions: Some collars have been removed, some others replaced. The ceiling has been lowered and new collars support it. Water tanks have been inserted and are supported by the original rafters.



Past interventions | link | I:\Arch\A



Open air water tank in roof | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☑

Brown rot in one of the visible rafter feet. Insect attack in other visible rafter feet and in a few rafters. All the timbers in the upper part, where the water tanks are, are very wet and damp.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



Brown rot in rafter feet | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Insect attack in rafter feet | link | I:\Arch\A

Description of visible damage

Other Notes: The inner walls are thicker than the outer, which suggests that the core of the house is of earlier date. In any case the roof structure is homogeneous thus it must have been replaced when the house was extended. There is evidence for reused timbers, which could have been taken from the earlier roof.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

DETAILED SURVEY **Building name** COCKENZIE HOUSE **Roof location** E range

Survey date(s) 22/01/2016 05/02/3016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings COH-E-1, COH-E-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
rafter	495*	square with wanes and bark	bending, compression	pinus sylvestris	hand axed
upper collar	200	square with wanes and bark	bending, compression	pinus sylvestris	hand axed
intermediate collar	270	square with wanes and bark	bending, compression		original ones are hand axed
lower collar	365	square with wanes and bark	bending, compression		original ones are hand axed
sole piece	50	square with wanes and bark	shear, tension	pinus sylvestris	hand axed
ashlar post	60	square with wanes and bark	compression, shear		hand axed
sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

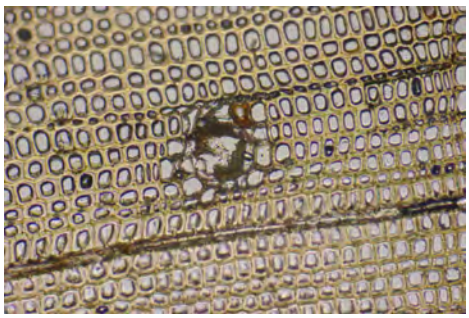
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings COH-E-1, COH-E-2

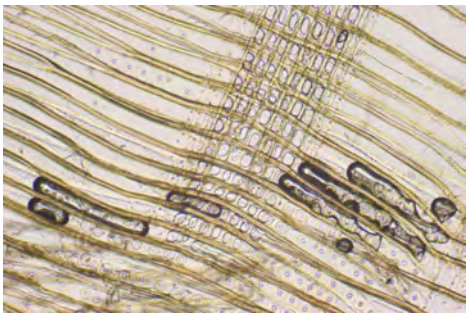
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter	Corner halved	compression	wooden pegs	pinus sylvestris
rafter & collar	Encounter halved	compression	nails	
rafter & sole piece	Corner mortice & tenon	compression, shear	wooden pegs	
rafter & ashlar post	Encounter mortice & tenon	compression, shear	wooden pegs	
sole pice & ashlar post	Encounter mortice & tenon	tension	wooden pegs	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

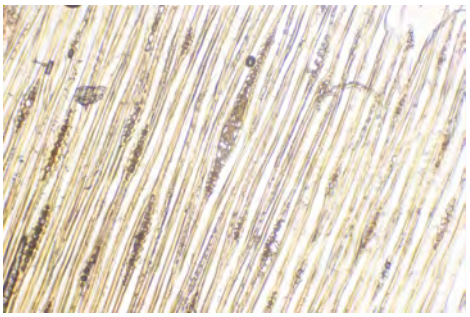
Microscopic identification of the timber species See drawings COH-E-2



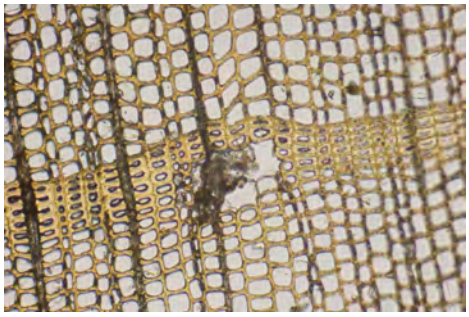
Sarking: transv. section x100 I:\Arc



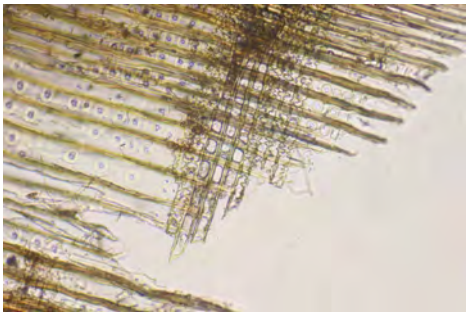
Sarking: radial section x 100 I:\Arc



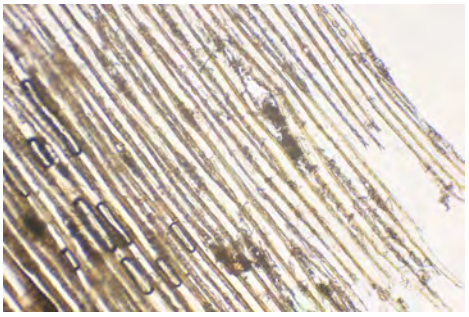
Sarking: tang. section x100 I:\Arc



Sole piece: transv. section x100 I:\Arc



Sole piece: radial section x100 I:\Arc



Sole piece: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawings COH-E-1, CH-E-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	W side	22/01/2016	12:40 am	9.8	82
attic space	W side	22/01/2016	12:20 am	9.8	77.7

roof space	W centre	22/01/2016	12 am	10.4	78.7
attic space	W centre	22/01/2016	11:40 cm	10.3	73
roof space	centre	22/01/2016	11:20 am	9	81.5
attic space	centre	22/01/2016	11 am	9.5	79
roof space	E centre	22/01/2016	10:40 am	84	87
attic space	E centre	22/01/2016	10:20 am	9.5	79
attic space	E side	22/01/2016	9:40 am	9.7	78
roof space	E side	22/01/2016	10:00 am	9	80

Frame/Truss name XX

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack: N rafter

Other: all timbers very wet

Element name A collar

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 12x10 | min. size (hxb) [cm]: 11x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 5 | tangential

Knots [min d/section h]: 4/9 | group | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other



bark | I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Element name B north rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 9.7x9.5 | min. size (hxb) [cm]: 9.5x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 6 | tangential

Knots [min d/section h]: 4/10 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Element name C south rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x11.2 min. size (hxb) [cm] 13x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 3.5/11.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Frame/Truss name non visible 16

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 12.7x10 | min. size (hxb) [cm]: 12x9.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 4 | tangential

Knots [min d/section h]: 2.5/10 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ | Type: | Status:

Way of identification:

Fungi attack ☐ | Type: | Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: | Way of identification:

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐ | External actions ☐ | Other ☐

Element name B north rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 12x10.2 | min. size (hxb) [cm]: 11x9.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 6 | tangential

Knots [min d/section h]: 4/12 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II



knots | I:\Arc

Material degradation

Insect attack ☐ | Type: | Status:

Way of identification:

Fungi attack ☐ | Type: | Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name C south rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 11.5x10.5 min. size (hxb) [cm] 11x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential
Knots [min d/section h] 3/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Frame/Truss name non visible 17

Missing elements
Elements with defects in critical area
Joints with decayed peg
Insect attack
Failed joints
Fungi attack
Other all timbers very wet

Element name A collar

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12x9.7 min. size (hxb) [cm] 12x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential
Knots [min d/section h] 2/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10x10 min. size (hxb) [cm] 10x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 1/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification



knots and diffuse insect exit holes I:\Arc

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Element name C south rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10x9 min. size (hxb) [cm] 9x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 1.5/9 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Frame/Truss name non visible 18

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐

Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x9.7 min. size (hxb) [cm] 13x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name B north rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 10.2x9.7 min. size (hxb) [cm] 9.5x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential
Knots [min d/section h] 2/9.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name C south rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 10.2x10 min. size (hxb) [cm] 10x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential
Knots [min d/section h] 3/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Frame/Truss name non visible 19 See drawing COH-E-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11x9.2 min. size (hxb) [cm] 11x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] 2/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 23 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 24.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse redundant lap joint below joint with collar

Timber treated ☐ Accessibilityissues lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.7x11.5 min. size (hxb) [cm] 11.5x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 4/15 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 22 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 26.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse redundant lap joint below joint with collar

Timber treated ☐ Accessibilityissues lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x11.5 min. size (hxb) [cm] 12x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 2.5/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



redundant lap joint I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 23.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 22.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name non visible 20

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack S rafter

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.5x9.5 min. size (hxb) [cm] 10x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 1/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name B north rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 9.5x8.7 min. size (hxb) [cm] 9x8.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential
Knots [min d/section h] 1.5/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name C south rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12.2x10 min. size (hxb) [cm] 11.5x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 10 tangential
Knots [min d/section h] 3/13 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



insect attack close to upper end I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐ External actions ☐ Other ☐

Frame/Truss name XVIIII

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 9.7x8 min. size (hxb) [cm] 9.5x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 1/9.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐ External actions ☐ Other ☐

Element name B north rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 12.5x11.5 | min. size (hxb) [cm]: 12x11 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 12 | tangential

Knots [min d/section h]: 2/11 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ | Type: | Status: | Way of identification:

Fungi attack ☐ | Type: | Status: | Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: | Way of identification:

Element name C south rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 11x9.2 | min. size (hxb) [cm]: 10x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 3 | tangential

Knots [min d/section h]: 1/9 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ | Type: | Status: | Way of identification:

Fungi attack ☐ | Type: | Status: | Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role



knots | I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Frame/Truss name XXII See drawing COH-E-3

Missing elements
Elements with defects in critical area
Joints with decayed peg
Insect attack
Failed joints
Fungi attack
Other all timbers very wet

Element name A collar

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12.5x9.7 min. size (hxb) [cm] 12x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential
Knots [min d/section h] 2/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 20.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 19.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction
Signs of reuse redundant lap joint below joint with collar
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.5x9.7 min. size (hxb) [cm] 12x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 4 tangential

Knots [min d/section h] 3/9.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a		
Moisture Content [%] 20.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 21.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse redundant lap joint below joint with collar

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.5x10.5 min. size (hxb) [cm] 9x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] 1/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other



diffuse insect exit holes I:\Arc

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 22.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 24.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name non visible 15 See drawing COH-E-3

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.5x8.5 min. size (hxb) [cm] 10x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] 3/10 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 25.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 24.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.5x9.7 min. size (hxb) [cm] 10x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 12 | tangential

Knots [min d/section h] 6/10 | group | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type | Status

Way of identification

Fungi attack ☐ Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 25.3 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 26 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction | Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.7x9.2 | min. size (hxb) [cm] 12x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 6 | tangential

Knots [min d/section h] 2/9 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type | Status

Way of identification

Fungi attack ☐ Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 27.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 34.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name X

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction | Signs of reuse redundant lap joint close to centre

Timber treated ☐ | Accessibilityissues | Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.5x10.5 | min. size (hxb) [cm] 12x10 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 7 tangential

Knots [min d/section h] 1/12 single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Element name B north rafter

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues | Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x10.5 | min. size (hxb) [cm] 12x10 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 3 tangential

Knots [min d/section h] 3/10 single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Element name C south rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.5x11 min. size (hxb) [cm] 12x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 4 tangential

Knots [min d/section h] 3/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Frame/Truss name XXV See drawing COH-E-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A upper collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status:

Way of identification:

Fungi attack ☐ Type: Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: | Way of identification:

Measurement Point a

Moisture Content [%]: 22.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 22.8 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B lower collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status:

Way of identification:

Fungi attack ☐ Type: Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 19.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 20 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C north rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Measurement Point b
Moisture Content [%] 22.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D south rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Measurement Point b

Moisture Content [%] 19 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name non visible 21 See drawing COH-E-3

Missing elements collar Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A north rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.5x8.7 min. size (hxb) [cm] 10x8.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 2.5/9.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 28 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 23.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B south rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 10.2x8.7 min. size (hxb) [cm] 9.5x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential
Knots [min d/section h] 2/9.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status Way of identification
Fungi attack ☐ Type Status Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 26.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 24.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name XX/III See drawing COH-E-3

Missing elements Elements with defects in critical area
Joints with decayed peg Insect attack
Failed joints Fungi attack
Other

Element name A collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status:

Way of identification:

Fungi attack ☐ Type: Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐

Estimated level of damage: | Emergency interv. needed ☐

Past interv. ☐ | External actions ☐ | Other ☐

Mater.Degr. and Damage Extent: | Way of identification:

Measurement Point a

Moisture Content [%]: 18.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 17.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B north rafter

Dating: original construction | Signs of reuse:

Timber treated ☑ probably for insects | Accessibilityissues: lower half not accessible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status:

Way of identification:

Fungi attack ☐ Type: Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 21.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 20.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name A south rafter

Dating original construction
Signs of reuse
Timber treated ☑ probably for insects
Accessibilityissues lower half not accessible
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects
Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation
Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage
Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 22.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 22 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name non visible 1 See drawing COH-E-3

Missing elements
Elements with defects in critical area
Joints with decayed peg
Insect attack
Failed joints
Fungi attack
Other

Element name A collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status: Way of identification:

Fungi attack ☐ Type: Status: Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: | Way of identification:

Measurement Point a		
Moisture Content [%] 26.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 26.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name B north rafter

Dating: original construction | Signs of reuse:

Timber treated ☑ probably for insects | Accessibilityissues: lower half not accessible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status: Way of identification:

Fungi attack ☐ Type: Status: Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 22 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 21.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse
Timber treated ☑ probably for insects
Accessibilityissues lower half not accessible
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 23.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 22.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse
Timber treated ☐
Accessibilityissues lower half not accessible
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12.7x8.5 min. size (hxb) [cm] 11.5x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 3 | tangential

Knots [min d/section h]: 2/8.5 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: active

Way of identification: Estimated

Fungi attack ☐ | Type: | Status:

Way of identification:

Corrosion ☐ | Wet surface ☑ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: | Way of identification:

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a			
Moisture Content [%] 21.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point b			
Moisture Content [%] 21.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point c			
Moisture Content [%] 21.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	

Frame/Truss name Vibis | See drawing COH-E-3

Missing elements: | Elements with defects in critical area:

Joints with decayed peg: | Insect attack:

Failed joints: | Fungi attack:

Other:

Element name A collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: | min. size (hxb) [cm]: | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ | Type: | Status:

Way of identification:

Fungi attack ☐ | Type: | Status:

Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 26.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 23.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status Way of identification
Fungi attack ☐ Type Status Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 23.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 21.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%] | Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a		
Moisture Content [%] 21.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 21.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name XXXV | See drawing COH-E-3

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other: all timbers very wet

Element name A collar

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%] | Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 25.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 21.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 24.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 24.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a		
Moisture Content [%] 22.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%]	Visible Material Degradation ☐	Not Accessible for: hygrometer ☑

Frame/Truss name non visible 14 See drawing COH-E-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 22.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 22.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 24.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 22.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a		
Moisture Content [%] 22.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 19.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name non visible 22 See drawing COH-E-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 30.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 28.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 22.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 23.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south rafter

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a		
Moisture Content [%] 21.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 26.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name XXI

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack S rafter

Failed joints Fungi attack

Other all timbers very wet

Element name A collar

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11x8.5 min. size (hxb) [cm] 10x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 1.5/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name B north rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12x10 min. size (hxb) [cm] 12x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential
Knots [min d/section h] 1/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name C south rafter

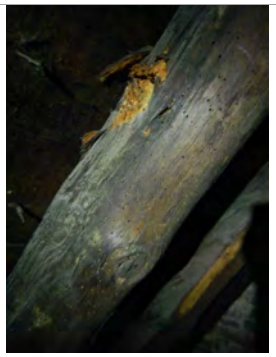
Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues lower half not accessible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12.7x10.5 min. size (hxb) [cm] 12.5x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential
Knots [min d/section h] 3/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



insect attack close to upper end I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage

Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

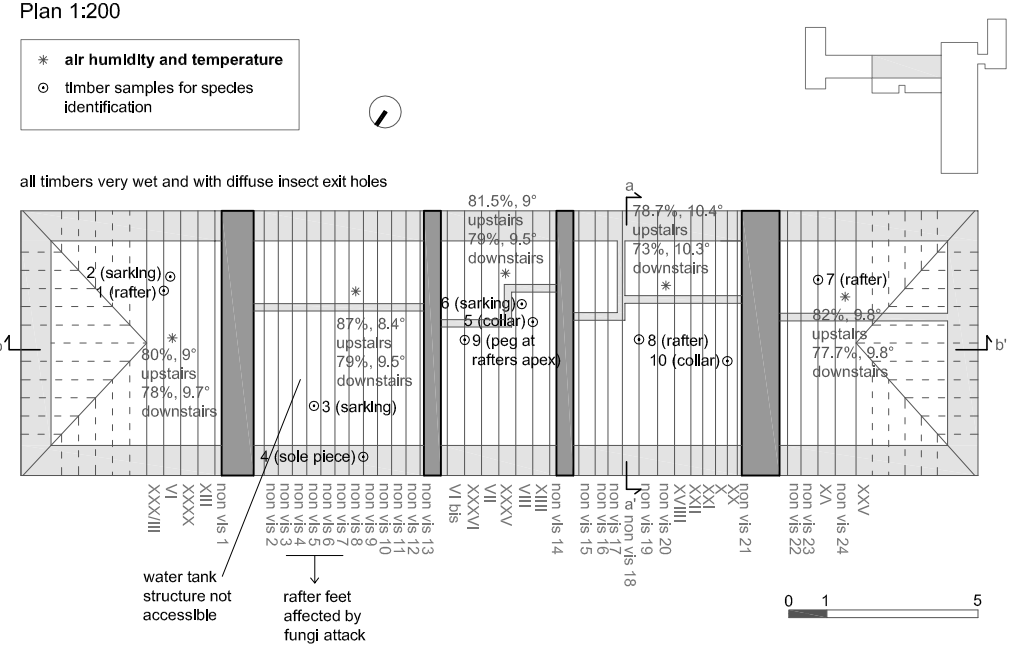
Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

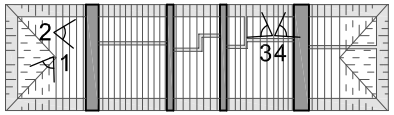
Other ☐

Plan 1:200

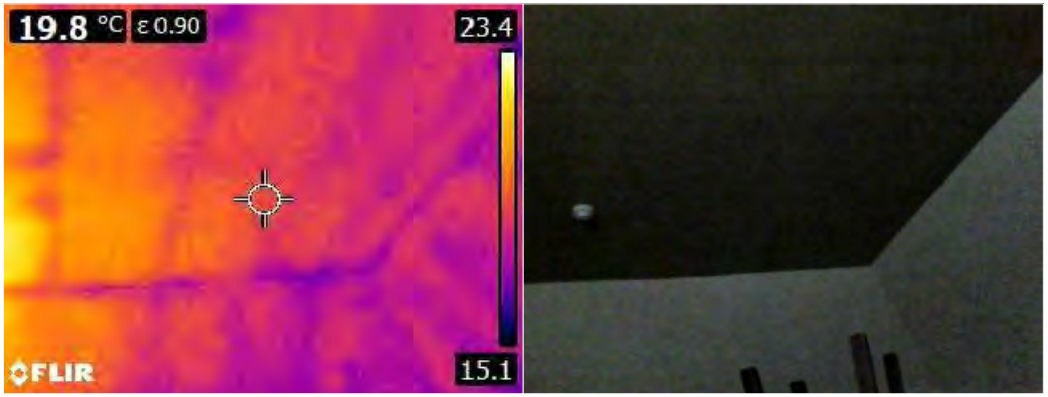


Themographic images

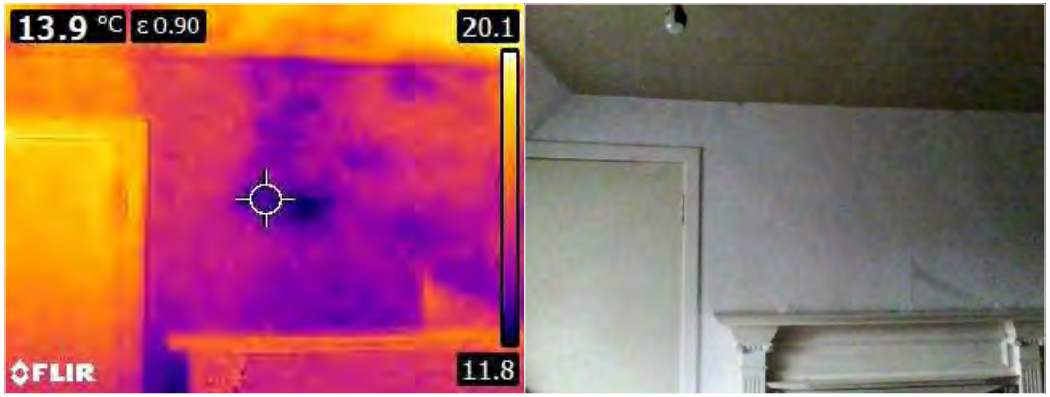
Plan 1:500



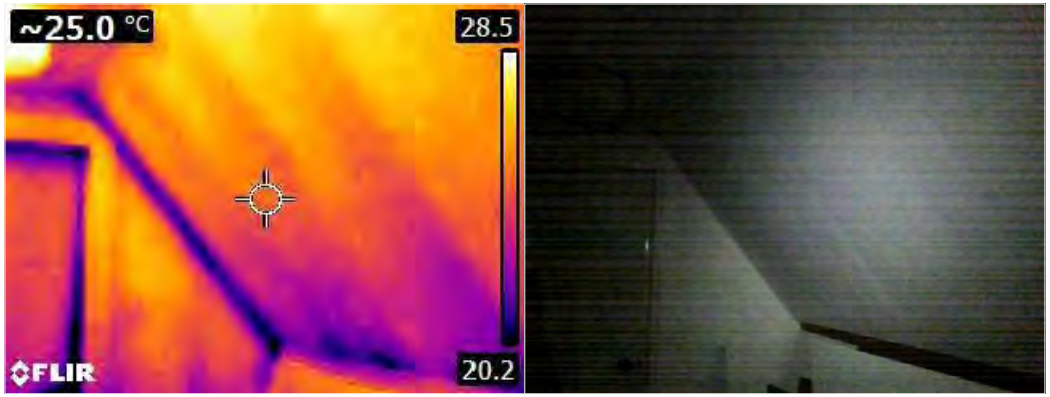
1: areas with lower temperature identifythe position of rafters and collars behind the plaster



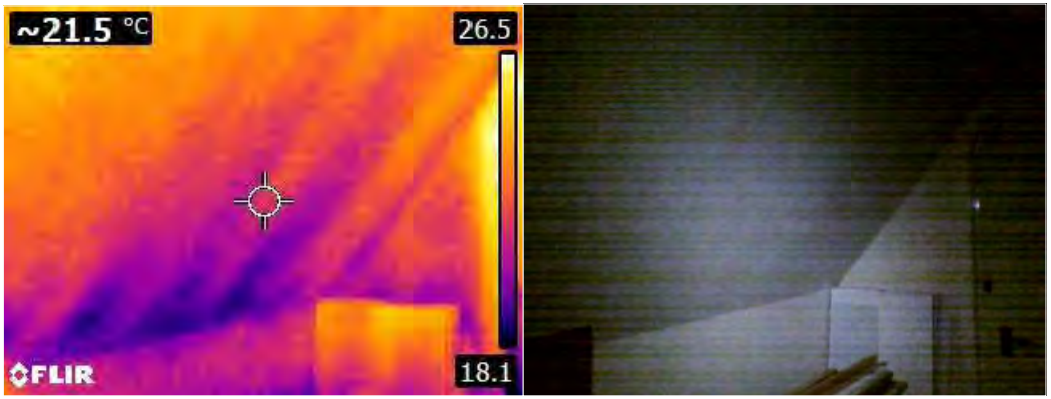
2: areas with lower temperature identify humidity on the gable probably due to deficiencies in the flashings



3: areas with lower temperature identify deficiencies in the flashings

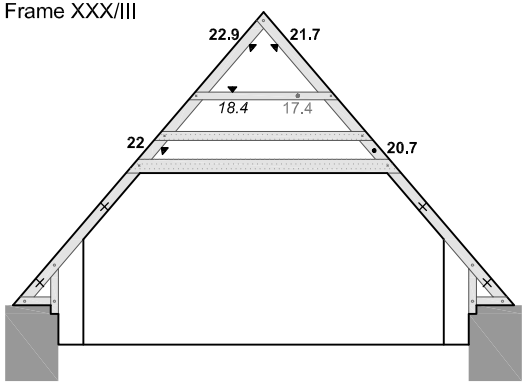


4: areas with lower temperature identify deficiencies in the flashings

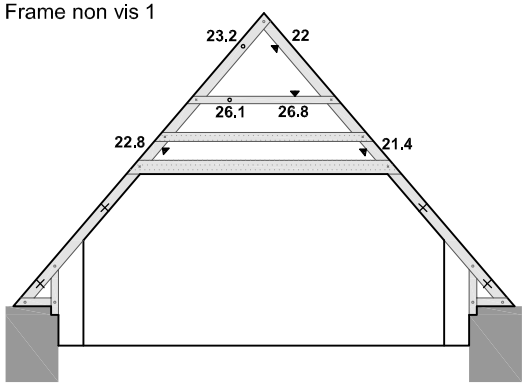


Sections looking West 1:100

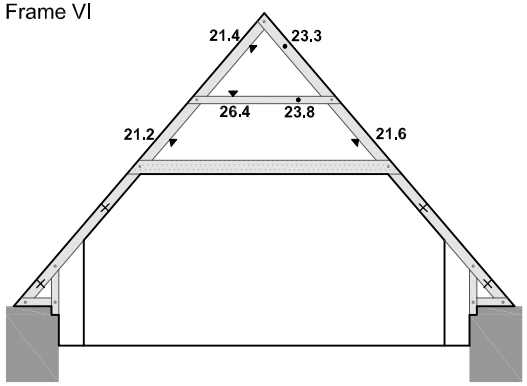
Frame XXX/III



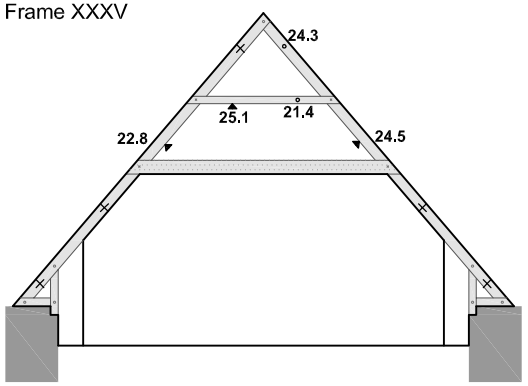
Frame non vis 1



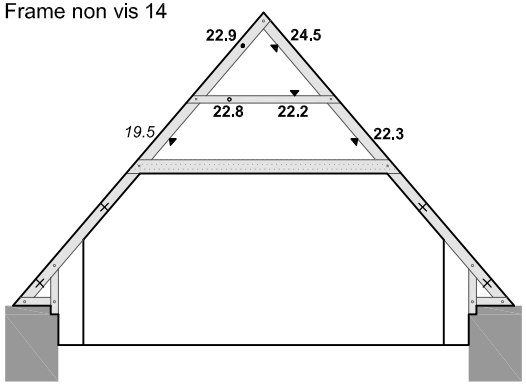
Frame VI



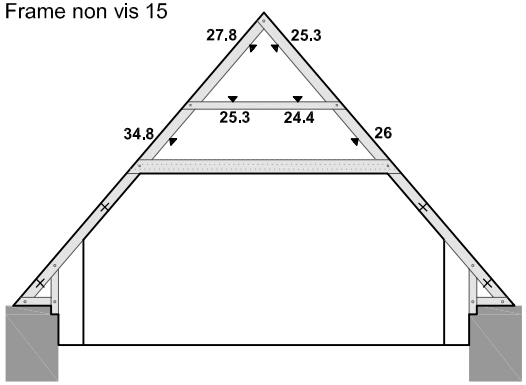
Frame XXXV



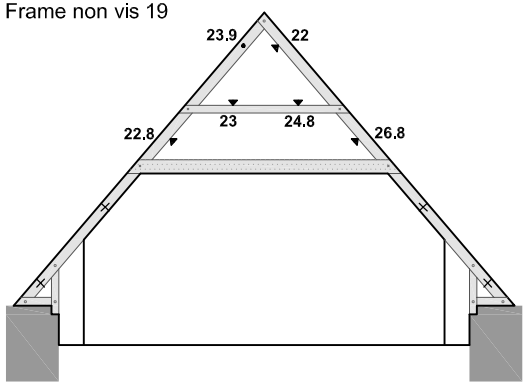
Frame non vis 14



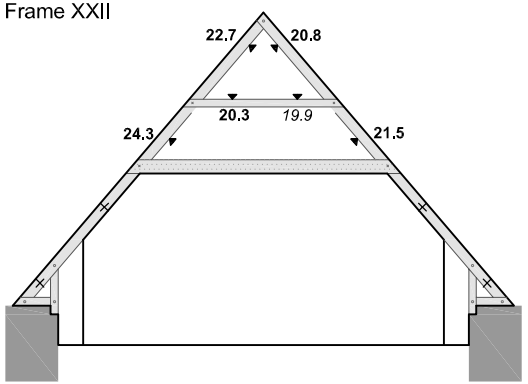
Frame non vis 15



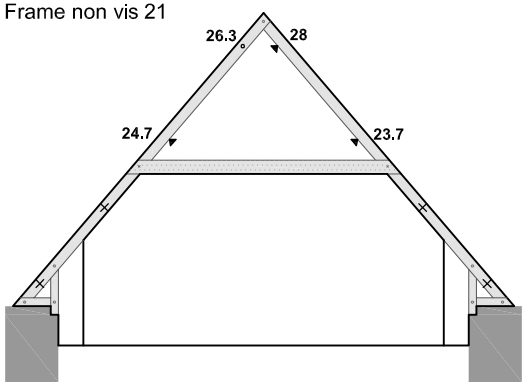
Frame non vis 19



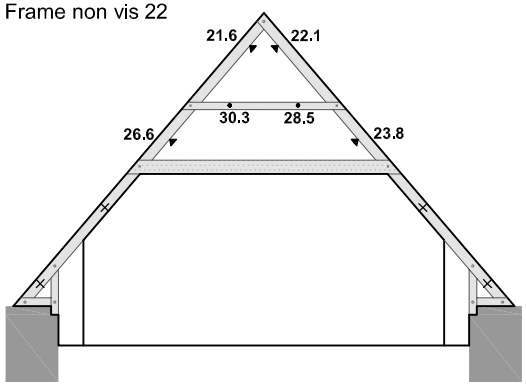
Frame XXII



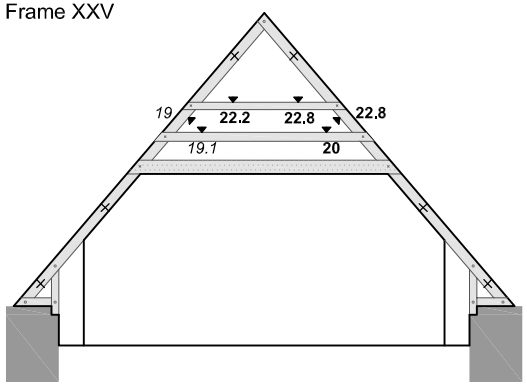
Frame non vis 21



Frame non vis 22



Frame XXV



Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- × not accessible

readings <18
readings >18
readings >20

0 1 5

Sections looking West 1:100

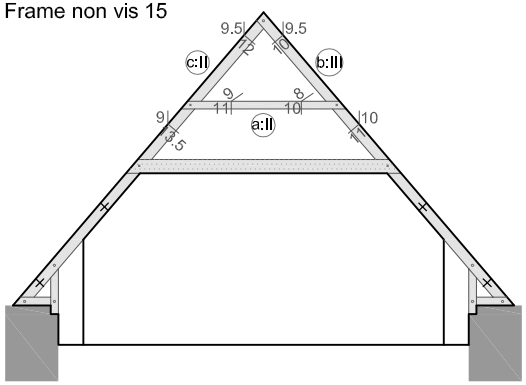
Visual inspection: many small knots & diffuse insect exit holes on most timbers

x:x element name : estimated strength class (na=less than 2 faces visible)

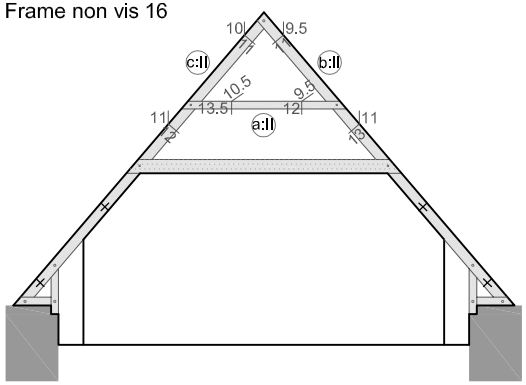
insect attack

fungl attack

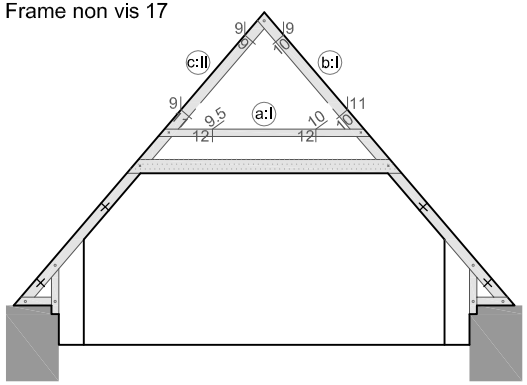
Frame non vis 15



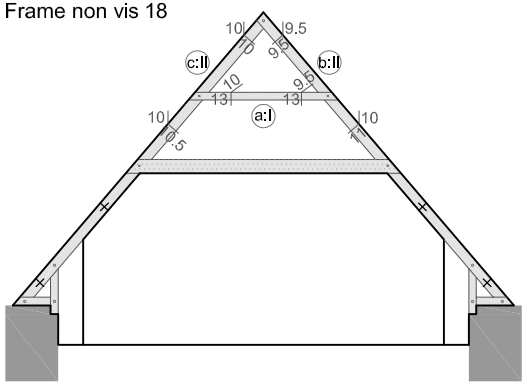
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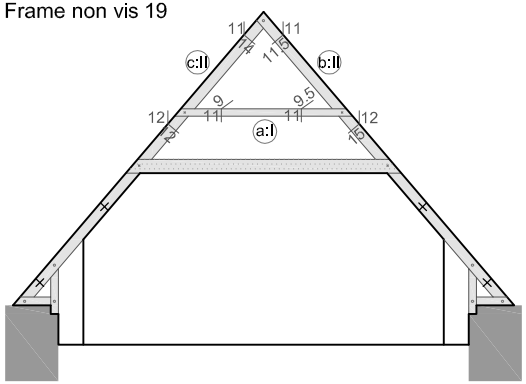
Frame non vis 17



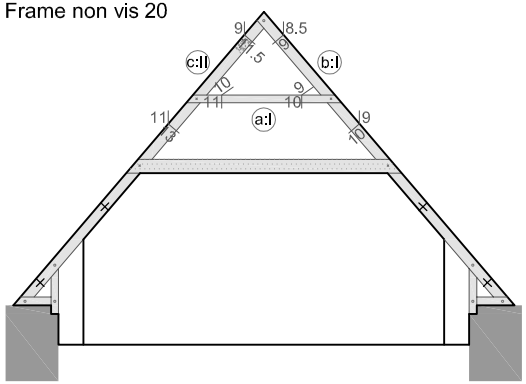
Frame non vis 18



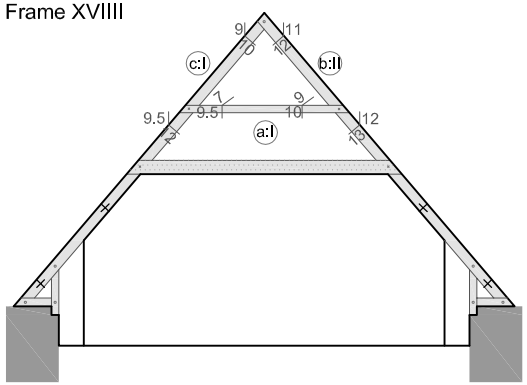
Frame non vis 19



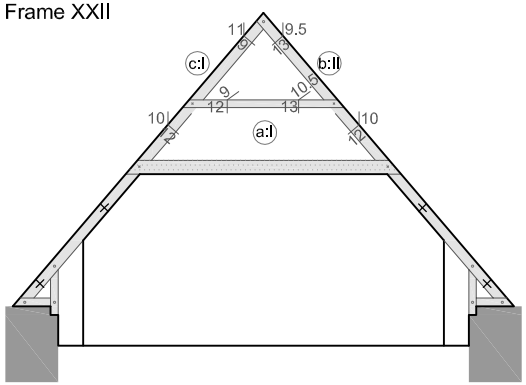
Frame non vis 20



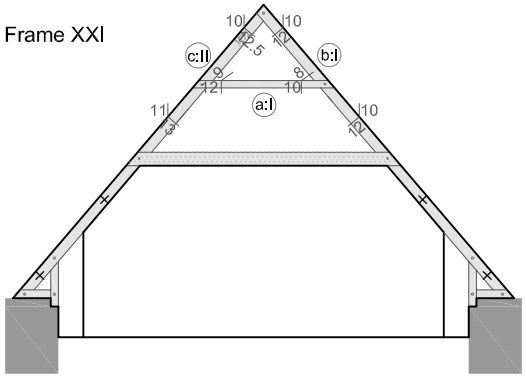
Frame XVIIII



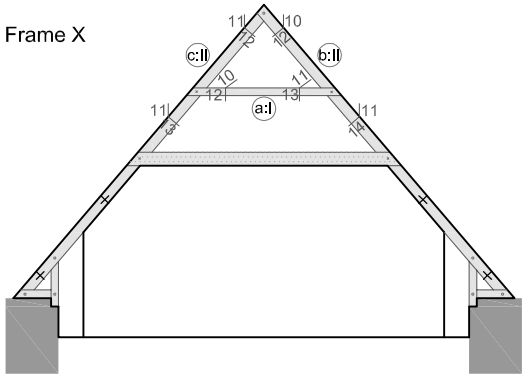
Frame XXII



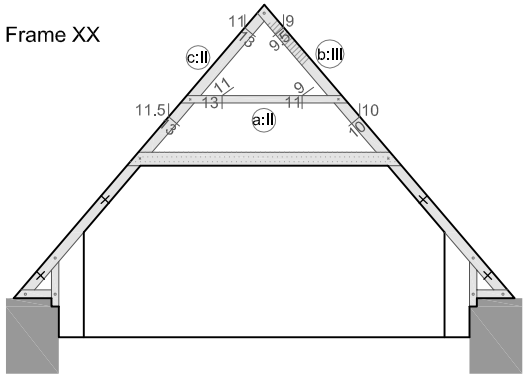
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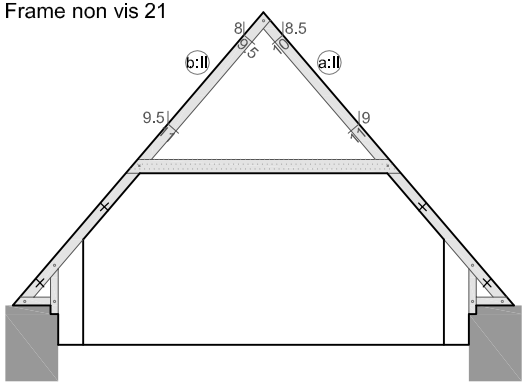
Frame X



Frame XX



Frame non vis 21



0 1 5

HOLYROOD PALACE

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)

X coordinate: 326896 Y coordinate: 673919

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE

Rcahms ID: 52380

HS Listing: A

Original Use: Residential

Current Use: Museum, Offices

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
ALTERATION, RECONSTRUCTION	1501	1505	S TOWER, CHAPEL, GALLERY, ROYAL APARTMENTS AND GATEHOUSE BUILT: A QUADRANGLE WEST OF THE ABBEY CLOISTER	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role
KING OF SCOTLAND	JAMES IV	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1528	1532	NW TOWERHOUSE ADDED TO NORTH RANGE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role
KING OF SCOTLAND	JAMES V	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
ALTERATION, RECONSTRUCTION	1535	1540	WEST AND SOUTH RANGES REBUILT OR REMODELLED. NEW CHAPEL IN SOUTH RANGE, THE OLD CHAPEL BECOMES THE COUNCIL CHAMBER. LONG GALLERY BUILT (NOT NECESSARILY ON SITE OF PRESENT LONG GALLERY).	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1544		PILLAGED AND BURNED BY INVASORS. PALACE STILL HABITABLE BUT NOT CONSIDERED 'FIT FOR LADIES'.	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1554	1566	UNSPECIFIED WORKS, MAYBE RECONSTRUCTION OF NORTH AND EAST RANGES	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1574		REPAIRS	CRAE UNPUBL.

People involved:

Last Name	First Name	Role
MCDOWGALL	WILLIAME	MASTER OF WORKS

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1616	1617	CHAPEL IN S RANGE RECAST AND REDECORATED. ROOF & PART OF STONEWORK TO CHANCELLOR'S LODGING REBUILT AND REPAIRS TO MANY APARTMENTS & SERVICE ROOMS	BUILDINGS OF SCOTLAND COLLECTION & ACCOUNTS OF THE MASTERS OF WORKS VOL.2

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1622	1623	CHANCELLOR'S LODGING IN THE COURT TO THE SOUTH ENLARGED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1633		REPAIRS TO CHURCH AND PALACE	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1650		FIRE IN EAST RANGE DURING OCCUPATION BY CROMWELLIAN TROOPS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1658	1659	WEST RANGE RECONSTRUCTED AND HEIGHTENED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION, CONSERVRESTOR	1662	1663	REPAIRS TO CHAPEL ROYAL, STABLES & COUNTERGUARD BUILT AND N QUARTER REBUILT - PROBABLY SOME MATERIALS REUSED	NRS E78/11 &

People involved:

Intervention type:	From:	To:	Description:	Reference:
SURVEY	1663			BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role
MYLNE	JOHN JUNIOR (3)	ROYAL MASTER MASON

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1671	1678	ALL RANGES REBUILT EXCEPT FOR W RANGE AND NW TOWER - SW TOWER ADDED - SOME TIMBER BOUGHT FROM NORWAY, OTHER FROM LINLITHGOW MILL	BUILDINGS OF SCOTLAND COLLECTION & NRS GD29/100 & NRS E36/30 & NRS GD29/94

People involved:

Last Name	First Name	Role
DUNSTERFIELD	GEORGE	PLASTERER
DE WET	JACOB	PAINTER
BRUCE	SIR WILLIAM	ARCHITECT
MYLNE 1	ROBERT 1	ROYAL MASTER MASON
SMITH 1	JAMES 1	CONTRACTOR, MASTER MASON
BAINE	JAMES	WRIGHT
EIZAT	ALEXANDER	WRIGHT
MCFARLAND	JAMES	WRIGHT

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1682	1686	WORKS TO FINISH AND REPAIR SOME INTERIORS AND ROOFS, WORKS AT COUNCIL CHAMBER, PRIVY CHAMBER AND ORATORY	EUL LA II 87 & NRS E37/24

People involved:

Last Name	First Name	Role
STIRLING	GEORGE	MATERIAL SUPPLIER
MCCLELAND	JAMES	WRIGHT
HAMILTON	JOHN	WRIGHT
DUNBAR	JAMES	MATERIAL SUPPLIER
BAINE	JAMES	WRIGHT
SMITH 1	JAMES 1	MATERIAL SUPPLIER, OVERSEER
MYLNE 1	ROBERT 1	ROYAL MASTER MASON

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1686	1687	THE DUKE OF HAMILTON DESCRIBES A FIRE IN THE GARRETS OF THE PALACE, POSSIBLY IN THE NE CORNER	EUL LAII87 1A & CRAE UNPUBL.

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1695		LORD JOHN HAMILTON DESCRIBES ROOF REPAIRS DUE TO FLOODING IN THE EARL OF ARRAN'S ROOMS (NW TOWER & W RANGE) CAUSED BY MELTING SNOW	CRAE UNPUBL.

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1721	1740	DUKE OF HAMILTON APARTMENT & OTHER INTERNAL ALTERATIONS - WORKS ON ABBEY ROOF	FLEMING 1962 & EUL LA II 88

People involved:

Last Name	First Name	Role
ADAM	WILLIAM	ARCHITECT, MATERIAL SUPPLIER
CLAYTON	THOMAS	PLASTERER
NORIE	JAMES	PAINTER

MOWBRAY	ROBERT	WRIGHT
SYME	JAMES	SLATER
CARNABY	WILLIAM	PLUMBER
WILSON	JAMES	SMITH
CHALMERS	RODERICK	PAINTER
BURTON	ALEXANDER	GLAZIER
BUTTER	WILLIAM	WRIGHT

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1755		NOT SPECIFIED	EUL LA II 88

People involved:

Last Name	First Name	Role
HAMILTON	JOHN	WRIGHT
DOUGLAS	JOHN	ARCHITECT
MACPHERSON	JAMES	MASON

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1791	1806	REPAIRS TO ROOF OF LIMITED EXTENT - REPAIRS TO LORD DUMMERES & DUKE OF HAMILTON & DUKE OF PORTLAND LODGINGS - REPAIRS TO ABBEY - OTHER UNSPECIFIED WORK	EUL LA II 88

People involved:

Last Name	First Name	Role
GORDON	GEORGE	WRIGHT
SALISBURY	JAMES	WRIGHT
BUTTER	HENRY	WRIGHT

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1824	1834	CLEARANCE OF BUILDINGS S OF THE PALACE AND REMOVAL FROM NW TOWER OF THE 1676 N ADDITION (LORD ROBERT STEWART HOUSE) - S FRONT REFACED IN ASHLAR - SE CORNER REBUILT	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role
REID	ROBERT	ARCHITECT
MATHESON	ROBERT	ARCHITECT

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1856	1880	S WING: INTERIORS, EXTERIORS AND ROOFS	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1879	1881	ROOF REPAIRS, EXTENT UNKNOWN	CRAE UNPUBL.

People involved:

Intervention type:	From:	To:	Description:	Reference:
DAMAGE	1900		FIRE IN S RANGE: CHARRED TIMBERS FOUND DURING REMOVAL OF PLASTER CEILING IN 1982	CRAE UNPUBL.

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CRAE J.		☑	PALACE OF HOLYROODHOUSE ROOFS	
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL FROM THE TWELFTH TO THE EIGHTEENTH CENTURY	130-138
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	77, 84
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	77-78
GONZÁLEZ LONGO C.	2012	☐	JAMES SMITH AND ROME	80-81
MICHAELSON K.	1984	☐	SCOTTISH ARCHITECTURE IN THE SEVENTEENTH CENTURY	12

Author	Year	Unpubl.	Title	Pages
SCOTTISH ARTS COUNCIL	1970	☐	SIR WILLIAM BRUCE, 1630-1710	11
WILLIAM A. (SIMPSON J.)	2011	☐	VITRUVIUS SCOTICUS. PLANS, ELEVATIONS, AND SECTIONS OF PUBLI BUILDINGS, NOBLEMEN'S AND GENTLEMEN'S HOUSES IN SCOTLAND	PLATE 1-5

ARCHIVAL REFERENCES

Archive	National Records of Scotland	Doc.Num.	GD124/15	Folios	471
Title	Letter to the Earl of Mar from Mr James Smith, surveyor of Her Majesty's works, in Edinburgh. He describes the dismal state of the Palace of Holyroodhouse and the Castle of Stirling.				
Archive	National Records of Scotland	Doc.Num.	E37/24	Folios	
Title	Estimate of materials required for reparation of Holyroodhouse, with notes of unfinished rooms their work to be done by Robert Mill under contract and of buildings and repairs necessary at Stirling Castle				
Archive	National Records of Scotland	Doc.Num.	GD29/100	Folios	
Title	Two copies of an order signed by Lauderdale terminating Sir William Bruce's appointment as Surveyor General, the building and repairing of Holyrudhouse [Holyroodhouse, Edinburgh] being completed - 30 May 1678				
Archive	National Records of Scotland	Doc.Num.	GD29/94	Folios	
Title	Contract between Sir William Bruce of Balcaskie, Surveyor General, Sir William Sharpe of Stainiehill, the King's Cash-keeper, and Robert Mylne, the King's Master Mason, for the building and repair of Halyrudehouse				
Archive	National Records of Scotland	Doc.Num.	GD29/95	Folios	
Title	Warrant by the Lords Commissioners of the Treasury to Sir William Bruce of Balcaskie, as Surveyor General to repair the Lord Chancellor's and the Duke of Hamilton's lodgings in Holyrudhous. Signed by the Lord Commissioners - 6/8/1673				
Archive	National Records of Scotland	Doc.Num.	E36/30	Folios	
Title	Sir William Bruce of Balcoskie: Holyrood, Stirling, Edinburgh, the Bass, 4 Mar. 1671-18 Jan. 1674, rendered 9 July 1674				
Archive	National Library of Scotland	Doc.Num.	Ms 14493	Folios	37
Title	Transcription by Aonghus Mackechie				
Archive	National Library of Scotland	Doc.Num.	Ms 14493	Folios	38
Title	Transcription by Aonghus Mackechie				
Archive	Edinburgh University Library	Doc.Num.	La II 88	Folios	1/8
Title	Accompt of large tree beams furnished to the roof of Holyrood 1733-4				
Archive	Edinburgh University Library	Doc.Num.	La II 88	Folios	3
Title	Note of money paid for repairs on Holyroodhouse since the union 28th Sept. 1806				
Archive	Edinburgh University Library	Doc.Num.	La II 88	Folios	2
Title	Accounts of several artificers employed in repairing Holyroodhouse 1733				
Archive	Edinburgh University Library	Doc.Num.	La II 88	Folios	1/1
Title	Accompt of Carpenter work performed at the Abbay of Holyroodhouse by Robert Mowbray wright 1733-4				
Archive	Edinburgh University Library	Doc.Num.	La II 87	Folios	1A
Title	Holyroodhouse, Stirling Castle, Dumbarton Castle, Edinburgh Castle Vouchers of expenditures on works (1684-86)				
Archive	Edinburgh University Library	Doc.Num.	La II 87	Folios	2
Title	Repairing Holyroodhouse for reception of the High Commissioner (8 vouchers)				
Archive	Edinburgh University Library	Doc.Num.	La II 87	Folios	3
Title	Timber for Holyroodhouse (1 voucher)				
Archive	Edinburgh University Library	Doc.Num.	La II 87	Folios	6
Title	Wright work at Holyroodhouse and Stirling Castle (4 vouchers)				
Archive	Edinburgh University Library	Doc.Num.	La II 87	Folios	7
Title	Timber for Holyroodhouse and fees of carvers (4 vouchers)				
Archive	Edinburgh University Library	Doc.Num.	La II 87	Folios	8
Title	Works at council chamber, privy chamber and oratory at Holyroodhouse (2 items)				

Suggestions for Further documents in Manuscripts Collections at NLS and Sir W. Bruce's accounts in NRS (E 36/31)

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive: National Library of Scotland | Doc. Num.: Ms 14493 | Folios: 38

Title: Transcription by Aonghus Mackechie | Date: from | to

Contents:
Off the counsell roome as follows
A thousand daills or therabout of 14 foot of lenth
2 formes for carpenters and on tressell
Some ???hes for playstering for sclaiters with trie? for slaiting and foot ganges
Above 5000 sclait ??? for nailing one
300 broad peises that came out of berwik
600 of uther lang jeists yt came be thomas mylne
500 of new dails [letter deleted?] *restand in pyls of the chapple*
scaffeling & uther materials for scaffling
22 laid of lyme in the stables
Of joists & scaffling to the stables
the chaple rigging stons all drest
All the pavement stones in the guard hall & presence
[The] *Materials that went doun to Leith by* [Cnall Murgen] *in Generall Monks tym wt? the wholl iron wark except doors & casements ??? the iron wark turned bak again by the Chanclers orders delivered to John Mylne Master masson*
Item the rest of all the timber wark of 900 joists and uther materials in the maister of work his hand & his servants yt was left since my lo| midletons tyme.'
[In margin on second page] *al this* afors[ai]d *was left in gnall monk his tym*

Summary and comments: materials for works in the council room - undated

Archive: National Library of Scotland | Doc. Num.: Ms 14493 | Folios: 37

Title: Transcription by Aonghus Mackechie | Date: from 1660 | to

Contents:
Holyrood [c.1660 – says catalogue]
[outside] *List Materials left in the Abay of Hollyrud's By General Monck given in by Mathew Hamiltoune*
[inside] *A memorandum of things or materials left be Generall monk of the abbay of holyrudhous for its repairing*
glass bands, iron bands for casements, *cross tailed garnes*? For ??? windows unturned *great bell nails for gates*, door hinges, locks, cross bands, blocks and tackle, scaffolding, , ???es for plastering, for slaters
5 ??? with their furnishing for the geates or: yeates
23 pair of great handles ??? for doors
68 pair of the best sort of all furnished
14 crosse bands for the chappill window
2 ??? for the new roofe
4000 nailes of severall sorts
53 chamber braises
ane great iron window with a ???esse on
3 new kithin? braises with ane old ane
60 laid of lyme…in tua voults
33 pains of glaisse received from Jon Brooks?
2000 plained boords in thrie? pyls
2400 of unplayned dails into thrie pyls in the pump? close
77 new doors not fixed nor ???thed
75 new windows wt caisments
6 great peace? of wainscot in the inner close
On barrell of thik tarre
36 thinne wainscot boords sawne great or small
25 jeists & 2 great? cons in twa pyls in the utter close
7 takells and 5 blocks
14 hurlebarrous & twa ledders
4 pickaxes & 3 schools?
ane suver for the pump
28 caisments & shutters for the windows

Summary and comments: In 1660 some deals and 2 other things 'for the new roof' have been left in Holyrood Palace and probably reused in the 1670s works.

Archive: National Records of Scotland | Doc. Num.: E36/30 | Folios:

Title: Sir William Bruce of Balcoskie: Holyrood, Stirling, Edinburgh, the Bass, 4 Mar. 1671-18 Jan. 1674, rendered 9 July 1674 | Date: from 1671 | to 1673

Contents

Hallyroodhouse 4 March 1671
Discharge
Imprs: paid to pitcairlis secret? for writeing two Charter parties betwixt Sr Wm Bruce & James Cook skipper in pittenween? upon ane Norway voadge? to be made by him for bringing home a loading of timber for the said works 2:R dollars £5 16s.
It paid for writing a contract betwixt the said Sr Wm Bruce & Thomas Mill indweller? in Leith upon acct of a quantity of timber to be bought from Norway for these works a half crown £1 10s.
[...]
Holyroodhous 16 June 1671
Imprs: paid to James Cook skipper in Pittenweem as followes for 800 long dailles bought by him at Norway at 13 1/2 doll. the 100 £313 4s.
for 1000 short dailles at 8 1/2 dolls the 100 £239 5s.
for 1300 dailles at 8 1/2 dolls the 100 £312 6d.
for 1000 short dailles at 8 1/2 dolls the 100 £246 10s.
[tot] *£1109 19s. 6d.*
It paid to provost mill of Linlithgow for great ??? trees bought from him for the use of the said works as followes
ffirst for 69 great trees 26 & 30 foot long & 14 inches square at 15£ each tree is 1035
It for 120 smaller trees 22 & 24 foot long 10 & 12 inches square at 8£ the piece (n. 9) 0880 [tot] *£1915*
It paid to James Baine wright for dailles bought from him for the use of the said works 50£ conforme to his accompt attested by the storekeeper that he received the same as followes
ffirst 400 dailles at 50£ the 100 £200
It 580 dailles at 54£ the 100 £306
[tot] *£ 506*
[...]
Holyroodhous 22 Julio 1671
[...] *It payed to the orge Rriffell? skipper in pittenweem 623£ for a loading of dealls & trees bought form him for the use of his Mayties works at holyroodhous as by particular accompt porder & received (n.17) £623*
Patrick Fyfe for knaple and wainscot
8 September 1671
Stones from Rotterdam
15 April 1672
Lead from Newcastle
It paid upon the 4 august 1671 to Robert Simpson skipper in Dysart thirteen hundreth nyntie ane pound fifteen shillings scots money in full & compleet payment of a loading of timber bought & receaved from him for the use of his Mayties works as accompt & receipt n. 55 £1395 15s.
16 June 1672
Imprs paid to William Bining? merchant in Edinburgh the sume of two thousand twenty three pounds ten shillings scots for a quantity of trees & dailles bought and receaved from him [...] £2023 10s.
Thomas Mill in Leith for deals and trees £273 8s.
7 September 1672
James Brune? merchant for deals and trees £2987 8s.
William Bining merchant 7000 deals £3220
18 October 1672
Bay Liverame dutch skipper 834 deals £380 18s.
Dutch plasterer
28 November 1672
James Tailrieser? 100 fir planks £435
John Veever? skipper in Lukestat? 1500 good deals £716
22 January 1673
Thomas Mylne indweller nine scoir? seventeen great shafts? £1595
Thomas Mylne greater and smaller shafts, fir planks, deals £2568 10s.
18 February 1673
Gibson Murray of Pittkeirie 7900 ordinary mert deals £3476
Sawing of 45 great shafts £45
25 July 1673
Sawing of trees £19 16s.
Many carters bringing timber and other materials from Leith to Holyrood
lead, tiles, plaster lime, hair for the plaster, ropes, nails, candles, sand, stones, ...
22 November 1673
Robert Mylne provost in Linlithgow planks, wainscot, deals £4142 16s.

Summary and comments

1671-3 account of timber & other materials for the Palace works - the timber is brought from Norway and from the mill of Linlithgow. Some is bought by James Baine as well, and other merchants in Edinburgh/Leith. Not all of the purchases are detailed, but those which are reflect a big quantity of timber material (thousands of deals of different types, great trees of different lengths and scantlings, planks, shafts) suitable for the major works carried out by Bruce & Mylne in those years.

Archive: National Records of Scotland | Doc. Num.: GD29/95 | Folios:

Title: Warrant by the Lords Commissioners of the Treasury to Sir William Bruce of Balcaskie, as Surveyor General to repair the Lord Chancellor's and the Duke of Hamilton's lodgings in Holyrudhous. Signed by the Lord Commissioners - 6/8/1673

Date: from 1673 to

Contents

Summary and comments: No details on works

Archive: National Records of Scotland | Doc. Num.: GD29/100 | Folios:

Title: Two copies of an order signed by Lauderdale terminating Sir William Bruce's appointment as Surveyor General, the building and repairing of Holyrudhouse [Holyroodhouse, Edinburgh] being completed - 30 May 1678

Date: from 1678 to

Contents

Summary and comments: No details on works

Archive: National Records of Scotland | Doc. Num.: GD29/94 | Folios:

Title: Contract between Sir William Bruce of Balcaskie, Surveyor General, Sir William Sharpe of Stainiehill, the King's Cash-keeper, and Robert Mylne, the King's Master Mason, for the building and repair of Halyrudehouse

Date: from 1679 to

Contents:
[outside] *Contract betwixt Sr William Bruce & Sr William Sharpe And Robert Mylne 1673* [...]
[inside] [...] *by his Majesty speciall order and appointment that his Majestys ryall palace and house at Holyrude house Be furtwith? repaired and builded in maner ??? And according to the designes and mappe therof both in plane and perspective exhibited and presented be the Surveyor generall to and approven be his Majestys* [...]
Robert Mylne needs to follow drawings presented by S. W. Bruce and agreed with the King - he shall furnish all materials necessary including *dailles and treesfor scaffolding and for centries and devalling? of the vaults* [...] *nailles*
Robert Mylne binds and obliges him and his forfes? to take doune and demolish the whole old pale? of building noe designed to be rebuilt and all other old works necessare to be takine dwne [...]
[...] *the inner court is to be enlarged as is designed to the space of sixty? ane foot and ane halfe squaire and to reddo the ground and fitt the samyne for sufficient and solide founding and to found and build therupon ane great towre upon the south pairt of the front of the palace equidistant from the ??? entrie ??? ??? front with the old tower ??? built opon the north pairt therof and that of lyme smooth and good ??? worke existing soe much as sower? for a gavell to ym lord chancelloire house and faills within the rooffe therof which is to be done in good sufficient cleared? rugh? work and every way to finish it in height breaith length shape doores rowmes and windows accoridng to the order and dimensiones in forme and maner lyke unto the old tower* [...]
[...] *according to the wrought and modell therof done and wrought in timber as? the samyne is designed be the Sr William Bruce* [...]
[...] *the said Robert Mylne binds and obliges him and his forfes? to take downe the stone worke of the gavells? of the rooffe above the Lobby and to build up ane syde wall in place therof of good aislar worke Also good and joyneing with the worke latlie? built above the old allering and raife? and joyne the samyne to the tower alse? high as the said new worke and soe continue up same from the south and of the said new worke and to joyne the samyne with the south tower now to be built and to finish the same with the doores windowes chimenys and entries according to the said draught*
kitchen court
garden walls
[...] *lykewaye the said Robert Mylne binds and obliges him and his forfds? to take downe the old worke betwyxt the north tower and the kirke and rebuild the samyne in good aisler worke with windowes conforme to and exactle according to the aisler of the tower and the worke of the windowes and tabling of the samyne excepting the uppermost tabling whereupon* [blank space] *rests which is to be a fyne cornish*
[...] *the aisler exactlie joyned and perfectlie smoothed ??? worke and other walls all off them with out band and in band stones compleatlie frtified for ther severall uses especiaillis for the supporting of rooffes and doors to the satisfactione of the said surveyore*

Summary and comments: 1679 detailed description of works to be carried out by Robert Mylne according to the design of Sir William Bruce, including the rebuilding of the North range – no details on roofs

Archive: National Records of Scotland | Doc. Num.: E37/24 | Folios:

Title: Estimate of materials required for reparation of Holyroodhouse, with notes of unfinished rooms their work to be done by Robert Mill under contract and of buildings and repairs necessary at Stirling Castle

Date: from 1682 to

Contents:
[outside] *Estimat of materialls to be provyded for the use and towards the reparation of his Ma.ties Palace of Holyroodhouse As also ane nott of such roumis as ar yet unfinished in the said Palace. Lykwayis A Particular nott of Buildings & Reparationis necessar at his Ma.tis Castle of Stirling*
18th July 1682
[inside] *Estimat of materialls to be provyded for the use, and towards the reparation of his Ma.ties Palace of Holyroodhouse, to be presently done, as follows viz*
lime for mason work & plaster in Duke of Hamilton and Treasurer and Lord Registers apartments
sand
rebats to make two arches in the Duke of Hamilton kitchen and a door in the Treasurer's apartment
stone plaster hair
door nails
[...] *whytning or spanish whyt?* [...] *for whytning of rooffs &syd? walls which stand in wood*
[...] *1000 daills* [...] *towards these reparations for sarking below the leaid work within the ??? Palace 48£ per 100* £480
[...] *half hundred double treis for the rofe of the work 18p. peece* tot. 54£
[...] *100 single trees at 9s. peece* £45
[...] *20 great trees for sawing at 2£ 10s. peece* £30

[...] *knappill for making new casem.ts*
[...] *5000 double floorings* [...] *for the rofe of the work at 10£ 1000* £50
single flooring
blind flooring
planshers
windows
[...] *1000 stones of lead [...] for helping of the main rooff & the infys of the wallheads & outfys of the ??? Palace*
[...] *half hundred great trees needful for making of garrons to lay upon the wallheads of the lead* [...] *at 1£ 10s. peece* £90
[...] *30 oak planks needful for going along the fare of the cornice whereupon the lead is to be layid at 1£ 10s. peece* £45
[...] *6000 scailie naills needful for putting on the slaits, that must be taken off the easing? in the infys of the Palace to get the lead*
[...] *layid in bilowit? at 5£ 1000* £30
[...] *100 prick? batts for putting on of the oak planks which project above the fare of the cornice at 4£ p.* £20
[...] *hogsheads of trass or pan cratch for pointing the alloring upon the wallheads & round the old tower?*
window nails
A particular nott of such roumes in the Palace of Holyroodhouse & others that are not yet finished nor completed viz.
[...] the rooff and the walls of the Pratches? from the great stairs to the door of the entrie of the Duke of Hamiltons lodgings is not yet plaistered
mason work that Robert Mill didn't do yet
A particular nott of Buildings & Reparations necissar at his Ma.tis Castle of Stirling as followes
[...] *Item the gallery or Transe w.ch enters the great hall being ane hundred feet long & thirten feet wyde wants the rooff and must be sarked and slated.*
[...] *Item the slait rooff of this Palace must be pointed & helped in severall of the flankers, or run rooff, as lykways the Bartisan covered with lead, together with the slait rooff and Bartisan of the great hall.*
Item the one side of the slait rooff of the Chappill became ruinous this last winter, and must newly sarked with dailles and newly slaites on that side; wheter the rooff y.rof be faulty or not cannot be known till the slaits & old sarken be taken off.
[...] *the slait rooffs of the whole castle would be pointed and a bargan made with a slaiter to maintain ym. yearlie hereafter upon a rentan yearly pension or sallarie.*
[...] *It is necessar all this work above mentioned be presently gone about* [...] *and for this effort it is necessar that money be provided for buying of materialls & payment of workmen* [...]
As to the particular Estimat, what these buildings and Reparations will cost at Stirling Castle it cannot be exactly sett doune without measuring of the dimensions of the places & rooffs to be built and repaired, w.ch must be done upon the place. [....

Summary and comments: 1682 materials needed to finish and repair Holyrood Palace: slates, sarking and lead but also some single, double and great trees – some are specifically for the 'roof of the work', thus it seems that some roof works were still ongoing at this time.

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 6

Title: Wright work at Holyroodhouse and Stirling Castle (4 vouchers) | Date: from 1684 to 1686

Contents:

1
[outside] *Accompt of wright work at the Palace of Holyroodhouse 1685 be James Mcleland £ Scots 1144 14s.*
[inside] [...] *December 1684 to Jully 1685*
Frames for paintings, windows, casements, new coach house, repairs to guard stables, tables, benches, beds, shelves, press, partitions, doors, ladders, ...
TOT £1144 15s. 8d.
2
[outside] *Accompt of wright work at Stirling Castle 1685 be James Mcland Scots £655 16s. 06d.*
[inside] *Accompt of wright work wroght at the Castle of Stirling Be James Mcleland frae 29 of May to 24 of September 1685 conforme to agreeement*
Lining floors and windows and walls, making shelves, barrowes, ladders, tresses, boxes, casements, garrones, partitions, doors, ...
For making & ane putting ane new roof on the maine gaird ??? of 27 couple & sarking of the??? £48 12s.
TOT £655 16s. 06d.
3
[outside] *Accompt of wright work Be James Mcleland at the Palace of Holyroodhouse fra Jyllu 1685 to March 1686 Scots £1031 2s.*
[inside] lining, flooring, casements, tables, presses, doors, shelves, windows, stairs, partitions, beds, replacing roof of stables and other repairs, ...
4
[outside] *Receipt Jon Hamiltone wright to Mr Jas Smith £6 7s, 5d. for reparatione in the foot guard. Hollyrudhous Scots £76 9s.*
6
[outside] *Instructions for the 8 article by the Abbreviat Acct.*
James McClealand and accompt for wright worke done at stirling and the abay £2879 10s. 6d.
[outside] *Abbreviat accompt of wright worke by James McCleland wright for worke done at the palace of Holyroodhouse and Castle of Stirling from december 1684 to march 1686*
Frames for paintings, High Commissioner accommodation, girnels, platforms, repairs at stables, benches, ...
TOT £2908 10s. 6d.

Summary and comments: Nothing related to roof structures

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 2

Title: Repairing Holyroodhouse for reception of the High Commissioner (8 vouchers) | Date: from 1684 to 1685

Contents: 1684-5 Reparations in the stables, plaster in King's room & oratory, partitions, doors, lathing the coach house

Summary and comments: Nothing related to roof structures

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 1A

Title: Holyroodhouse, Stirling Castle, Dumbarton Castle, Edinburgh Castle Vouchers of expenditures on works (1684-86) | Date: from 1684 to 1687

Contents:
[outside] Missing part
Mr James Smith
By
An accompt of money payed to severall persons for work & materialls furnished for the use of his Maj Palace & Castles from 14 Aprile 1684 to 1 of March 1686
[inside] *By an accompt of money payed to Mr James Smith overseer to his Mties works, and to his orders by Hugh Wallace of Inglistoun his Majesties cashkeeper from 14 Aprile 1684 to 1 March 1686*

1. Clearing casway-layers and others in Edinburgh Castle £360
2. Not specified £7704 4s.
3. To pay workers £4093 11s. 10d.
4. Not specified £657 15s.

TOT £12814 10s. 10d.

Received by J. Smith
By an accompt of money debursed by Mr James Smith overseer to his Mties works to the particular persons after mentioned for work don and wrought by them at his Maties Palace and Castles conform to the particular instructions afterspecified from 14 Aprile 1684 to March 1 1686

1. Casway men, levellers, sandmen, workmen and others to carry sand and stones and levelling the ground at Edinburgh Castle £1481 9s.
2. *It. to several persons for workmanship and furniture in repairing the Palace of Holyroodhouse for the reception of his royal highnes* […] *and afterwards continued for his Grace the Duke of Queensbury* […] *his accommodation anno 1685* […] £1002 18s.
3. Other people for works at Holyrood £1060
4. James Alexander and Mr Kikeus for painting at Holyrood and Edinburgh Castle £705
5. *To Robert Marshall wright in Dumbarton and others at Stirling* for defenses £720 18s.
6. *To James Mccleland & John Hamilton wrights for work don at the Palace of Holyroodhous & Castle of Stirling as the accompts & recepts from Dec. 1684 to March 1686* […] £ 2908 10s.
7. To James Dunbar merchant for deals and trees and two carvers brought from London to carve his Majestys statue in marble to be set up in the middle of the court of Holyrood £ 2321 16s.
8. To James Baine wright and John Callander smith for work at the Councill Chamber and windows of the privy chamber & oratory at Holyrood £629
9. Alexander Chambers for clensing walls at Edinburgh Castle £97
   James Smith for visits to Blacknes, Dumbarton, Stirling Castles and the Bass £120
10. *To severall persons who were active in smothering & suppressing the fire in his Ma. Palace of Holyrood hous Feb. 1686* […] £173 4s. 4d.
11. John Mastertoun glass work at Holyrood and Edinburgh Castle 1683-4-5-6 £1130 14s.
12. *To severall persons for reparations don at his Ma. Palace of Holyroodhous in the latter end of 1685 and beginning of 1686 about the stables and other office houses* […] £463

TOT £12814 10s. 10d.

Summary and comments: Abstract of specific accounts of James Smith surveyor general between 1684 and 1686 at Edinburgh Castle, Dumbarton Castle, Stirling Castle, Holyrood Palace. Repairs are carried out at Holyrood Palace for the reception of the king, in particular works are carried out at the Councill Chamber, the Privy Chamber and the Oratory. The wrights James Mccleland, John Hamilton, James Baine, and the merchant James Dunbar are paid for timber work and materials.

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 8

Title: Works at council chamber, privy chamber and oratory at Holyroodhouse (2 items) | Date: from 1684 to

Contents:
[outside] *Accompt and receipt James Baine for by works at the Abay for £567*
[inside] *Instructions for the 8 article relative to worke done by James Baine inm the Coucnell Chamber & privie chamber & others in His Maties palace of Holyroodhouse over & above the ??? he had done there by contract in the years 1684*
furniture

Summary and comments: Nothing related to roof structures

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 3

Title: Timber for Holyroodhouse (1 voucher) | Date: from 1685 to

Contents: 1685 George Stirling 1200 deals from timber bush in Leith £480

Summary and comments: Deals probably for works carried out by J. Macleland in 1684-5

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 7

Title: Timber for Holyroodhouse and fees of carvers (4 vouchers) | Date: from 1686 to

Contents: [outside] *Instructions for the seventh article relative to timber bought & the fee of two carvers*

Scots 2321 16s..
[inside] […] James Dunbar merchant in Inverness for a loading of timber £701 8s.
Custom house, carriage, carvers to make the king's statue in marble
(1)
[outside] *Receipt James Dunbar mert. In Inverness for £ 58 9s. £701 8s.*
[inside] *Ane accompt of timber bought be Mr James Smith from James Dunbar mert. In Inverness the 16th Janry 1686*
1100 Bergen deals, 9 dozen long deals halved, 12 dozen double trees, 10 single trees, 8 dozen fire planks, 2 other dozen deals
TOT £58 9s.

Summary and comments: Deals, trees and planks probably for works carried out by J. Macleland in 1684-6

Archive: National Records of Scotland | Doc. Num.: GD124/15 | Folios: 471

Title: Letter to the Earl of Mar from Mr James Smith, surveyor of Her Majesty's works, in Edinburgh. He describes the dismal state of the Palace of Holyroodhouse and the Castle of Stirling.

Date: from 1707 to

Contents:
Mr Ja. Smith concerning the Abie of Halarudhouse & Stirling Castle
Novemb. 6 1707
My Lord
since I have been preferred to be surveyor of Her Ma.tis works, I ame bound in duty to informe that unless some serious settled measure be laide doune for keeping her Ma.tis palace castles and forts in repaire they'l infallibly go all to ruine.
My lord the palace of holyroodhouse is in so dismail a conditione both in the roof & windowes that I ame ashamed to write of it, but ther is ane absolute necessitie of keeping it in repaire otherways it will inevitably perish if 500£ be bestoned by the housekeeper as I shall advise and the bond? made sune? it may be? more than a thousand pounds laide out in the ordinaire maner. What I say of the palace of holyrodhouse I may say meane? the same of the castle of stirling with the additione that the platforms and embrasures are all ruined the half being all ??? doune with the flashes of ??? and the other rotten having been made only of firr wals many years agoe but I ??? not head farr. I ought to medle? in this affaire, it being properly I being properly the Mr of Ordonance his post to judge of and ordar these things and if any thing ??? a ??? of artiglarie be kept in thy place (of which I doubt) the master of the ordnance may order me or ??? of ane under him to represent the thing for there is ane absolute necessitie of looking after ??? in all the branches both in ??? Castle ??? Stirling as for ??? ??? not but Major Grall Maitland has given informatione since his affairs ??? ane but in a maner a doing wants greate support.
My lord wherin I am short or out of the ??? I hope will be pardoned when it is considered of preceeeding from My Lo
your most obliged dutifull most humble servt Smith

Summary and comments: In 1707 James Smith, the King's Surveyor General, says that the roof of Holyrood Palace and Stirling Castle are in bad conditions – it is not clear if his evaluation is limited to the slates and sarking, or comprises the structure as well.

Archive: Edinburgh University Library | Doc. Num.: La II 88 | Folios: 3

Title: Note of money paid for repairs on Holyroodhouse since the union 28th Sept. 1806

Date: from 1721 to 1805

Contents:
[outside] *Note of money paid for repairs on Holyroodhouse since the union 28th Sept. 1806*
£23646
[inside] *Note on Money paid for repairs on Holyroodhouse since the union*
1721
Robert Moubray wright £80
Joseph Forester plumber £80
Gilbert Smith mason £12
Alexander Burton glazier £40
James Wilson smith £10
James Syme slater £40
TOT £262
1722
Same + Alexander Syme painter
TOT £646
1723
same
TOT £993
1733
Same + William Adam
TOT £3000
1735
William Adam £100
1754
W. Moncrieffe for paying workmen £400
1755
W. Moncrieffe for paying workmen £450 (John Douglas architect, William Hamilton wright-paid £380-, James Mcpherson mason, Mr Richardson smith, John Lamb smith)
1762
Clock repairs £21
1771
W. Moncrieffe for paying workmen £50
1772

W. Moncrieffe for paying workmen £17
1774
W. Moncrieffe for paying workmen £10
1777
Repairs of apartments £7
1779
Duke of Hamilton for repairs on Holyrood £450
1780
James Reid for building a wall at the watergate £10
1791
Ramsay slater £91
James Salisbury for repairing roof £10
1792
Marshall Armstray plumber £89
Archibald Ramsay slater £11
1793
Clock £50
1794
Henry Butter carpenter for repairs of Lord Dummeres? Lodgings £52
James Gordon for cutting drains £60+71
??? £126, £35, £150
Adam £1442
Marshall Armstray plumber £100
??? £14
Charles Hamilton for repairs of Duke Hamilton's lodgings £29
??? £80
??? carreyer £53 + £20 + £70
Marshall Armstrong plumber £49
George Gordon Carpenter £23
1795
Mr Butter wright £6
??? £21
Glazier £2
Repairing paintings £25
William Archibald mason £198
George Wilsh for causewaying £366
John Butcher slater £30
Marshall Armstray plumber £120
George Gordon carpenter £9 + £43
??? clockmaker £16
W. Lauson plasterer £36
John Medina painter £30
1796
??? £27
Duke of Portland apartments £1000 + £1500 +£4000
William Sibbald mason £650
1797
Royal apartments £700
1798
Duke of Portland apartments £400
??? mason and other workmen £600
1799
??? £600
1801
Repairs on abbey £400 + £182
Archibald Ramsay slater £5
John Baron painter £4
1802
Repairs £2000 + £200 + 1000
1803
Repairs £300 + £300
1805
Repairs £200 + £150 + £150
TOT £23646

Summary and comments	No details of works but the sums paid for carpentry works are limited, thus no extensive works were probably carried out during the 18th century on the roof structures.

Archive	Edinburgh University Library	Doc. Num.	La II 88	Folios	1/1

Title	Accompt of Carpenter work performed at the Abbay of Holyroodhouse by Robert Mowbray wright 1733-4	Date: from	1733	to	1734

Contents [outside] *Accompt of Carpenter work performed at the Abbay of Holyroodhouse by Robert Mowbray wright 1733 & 1734*
[inside] *Accompt fo carpenter work performed at the Pallace of HolyRood House by Robert Mowbray His Majestys Master Carpenter in Scotland between the 19th July 1733 and.*
To 2485 yards of roofing and sarking including the taking up of the old sarking & rotten timbers of the roof, sawing new sweeps out of great beams, furnishing nails thereto, the sarking being jointed and seemed, also the battons on the ridge of the roof & peans of the angles & garret windows at 2sh. Pr. Yd. £248 10s.
Doors £3
To making a crane to hoist up the great timbers & sheet lead from the court to the platform above the Duke Hamilton's lodging £2
To making a scaffold and gangway between that platform & the main Roof for carrieing the lead ecc £1
Table & other tools for plumber £1 15s.
To making a strong frame 48 feet long & 6 deep of square timber to support the couples of the roof on the south side of the church wt. nails ecc £4 10s.
To repairing all the sarking of the 4 garrets in the front & making scaffolds on them for the wrights and sclaters £9 2s.
Other tools for plumbers £9
Scaffold for the masons £1 3s.
Moulds and rules for masons 18s.
Lodge for masons £1 15s.
To mending a floor in the Duke of Argyles appartment that was rotten by the rain that came through the roof £10 10s.
Door £9
Door £4
Door £5
Windows £1 12s.
Locks £7
Scaffolds £7 3s.
Clock £1 10s.
Lath and plaster in garret £16 8s.
Demolishing stable £18
Lining £9
Mason putting ducks in the stone wall £ 1
Nails £3
Mouldings £11
Mouldings & panelling £7
Tables and shelves 15s.
Painting 3s. 6d.
Ladders 7s.
TOT £316 6s. 6d.
Work measured by James Buchanan and William Adam and paid

Summary and comments 1733/34 works at the Abbey roof carried out by carpenter Robert Mowbray.

Archive Edinburgh University Library Doc. Num. La II 88 Folios 1/8

Title Accompt of large tree beams furnished to the roof of Holyrood 1733-4 Date: from 1733 to 1734

Contents [outside] *Accompt of timber to the Abbay 1733 & 1734*
[inside] *Accompt of large tree beams furnished to the rooff of the Abbay from 31 July 1733 to 24 September 1734 both inclusive*
[…] *To 328 largest choiced firr beams mostly 26 foot long from 10 to 16 inches square being cutt out for new framing the sides of the rooff and storm windows, also in replacing severall of the principall beams of the rooff which were rotten by the rain watter coming in upon the timbers, each new beam att £? £410*
Accompt of planks & dealls furnished to the above rooff
Broad fir planks 15, 16, 17, 18, 24 feet long – some 4 inches thick, some just *thick* or *thinner* (some from Portseaton)
Double 10, 12 feet deals – some 2 inches thick, some just *thinner* (some from Norway)
Single deals 9 feet long
Large slabbs for cleats?
Large double trees
TOT £874 13s. 6d.
Furnished by William Adam

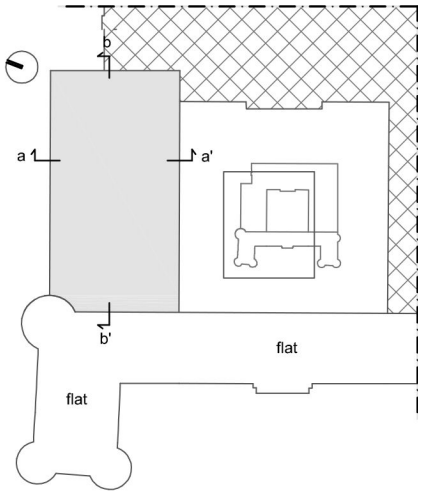
Summary and comments 1733/34 William Adam furnishes timber for the works at the Abbey roof.

Archive Edinburgh University Library Doc. Num. La II 88 Folios 2

Title Accounts of several artificers employed in repairing Holyroodhouse 1733 Date: from 1735 to 1736

Contents [outside] *Abstract*
Workmen's acct. for repairing the Abbey signed by Mr Philp
26th ??? 1735/6
???gned precepts for paying the ballances
[inside] *An abstract of the accounts of the several artificers employed in repairing his Majesty's Palace of Holyroodhouse, pursuant to his Majestys Royal Sign manual dated the 10th day of August 1733*
Robert Moubray wright £316 6s. 6d.

	James Syme slater £191 15s. 6d. William Carnaby plumber £260 William Adam architect £2210 2s. 1 5/12d. mainly for materials furnished (slates, timber, lead, stone) but also for the smith's, clock maker's account, painter's and glazier's accounts
Summary and comments	No details of works, but it's probably related to the 1733/34 works at the Abbey roof.



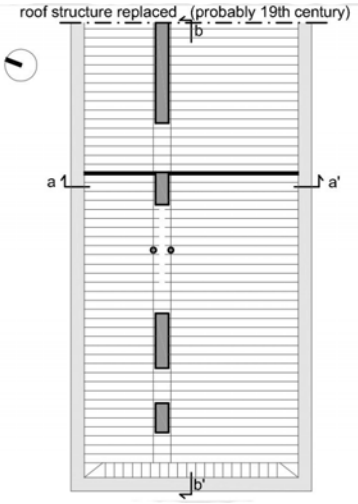
Legend (plans):

Plan 1:1000

- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500

- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



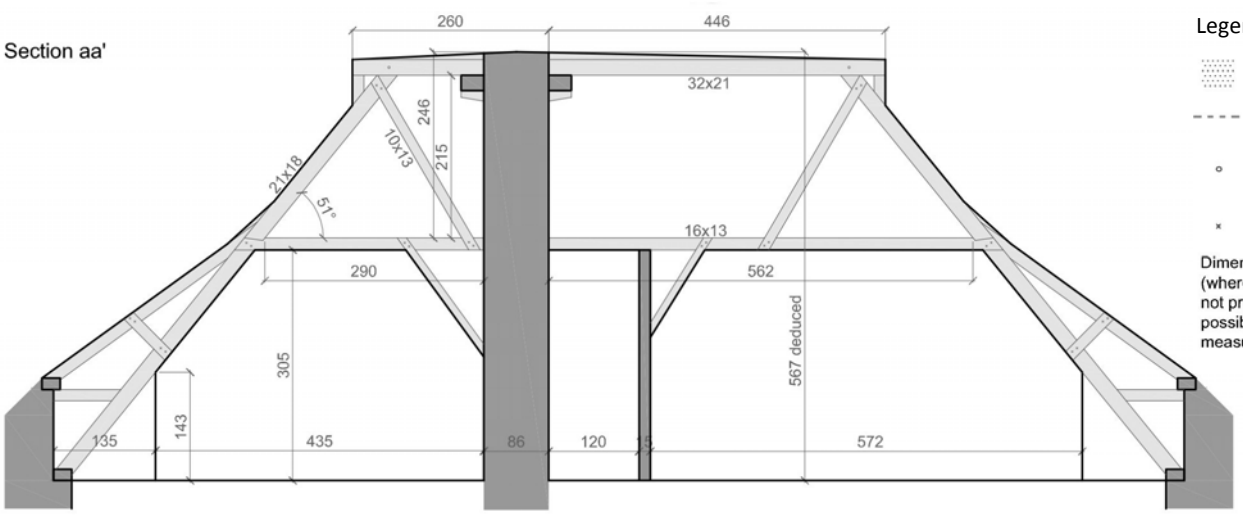
Carpentry marks from west to east:

IIII	XXII	XXXIX
V	XXIII	⌐IX
VI	XXIIII	XΓI
VII	XXV	XΓ II
VIII	XXVI	XLIII
VIIII	II/XX	XXXXIV
X	XXVIII	XXXXV
XI	XXVIII	XXXXVI
XII	XXX	XXXXVII
XIII	XXXI	XXXXVIII
XIIII	IIXXX	XXXXIX
XV	XXXIII	XXXXX
IAX	XXXIIII	not visible
XVII	XXXIV	not visible
XVIII	XXXV	
XVIIII	XXXVI	
XX	XXXVII	
XXI	XXXVIII	

Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'

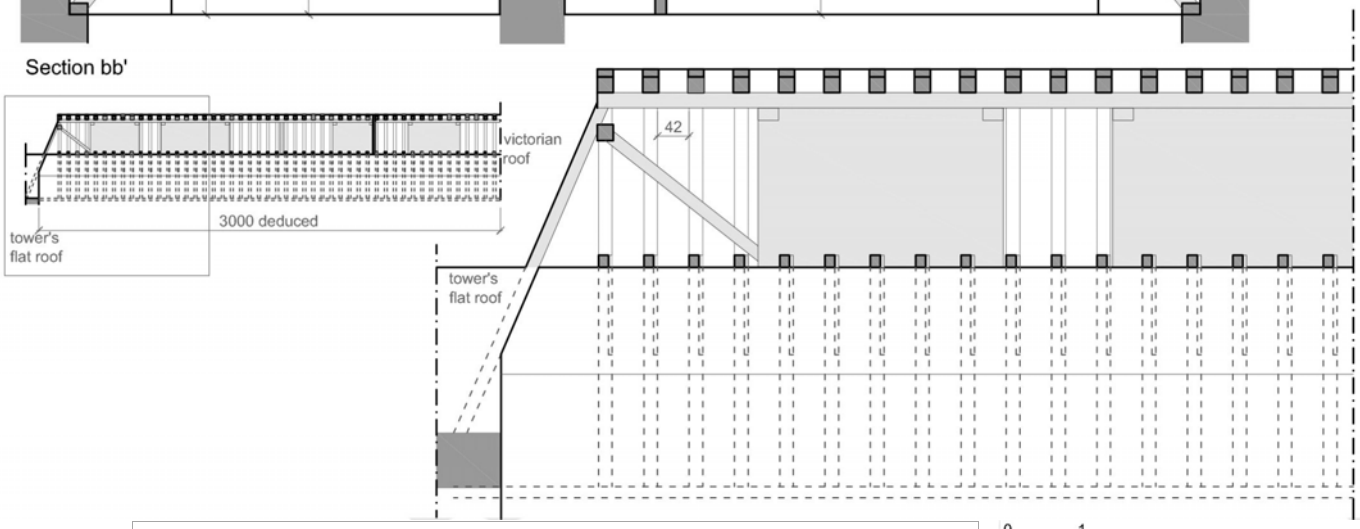


Legend (section):

- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** HOLYROOD PALACE | **Roof location** N range

Survey date(s) 08/09/2014 | See drawing: HP-N-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 8.2 | Roof Height [m]: 4.8

Roof Pitch/es [°]: 54 | Roof Length [m]: 30

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Other

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking

Sarking boards: width [cm]: 26 | thickness [cm]: 2.5

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1671 To 1679 | Identified by: Estimated

Roof General Description:

Only N range retains original roof structure. It incorporates the 16C palace and chapel royal. Hipped platform roof supported by an intermediate longitudinal wall. Timber beams span transversally and sit on this wall - they are connected on the sides to the rafters. Lower beams span from the rafters to the intermediate wall and support the ceiling of the attic rooms. Rafters and lower beams are connected by struts. All timbers are hand-axed whole logs. Struts are smaller and roughly dressed.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 21 | B: 18 | Or Purlin - H: | B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Between upper beams and rafters: mortice and tenon with timber pegs not flush; between rafters and struts: half lapped with metal pins; between rafters and lower beams dovetail lapeed with metal nails.

Wood Species: All elements, including sarking: Pinus sylvestris) - Pegs securing joints between elements: oak

Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

In sequence, numbered from IIII to XXXXX from west to east. First 3 frames removed?

Signs of reused timbers: A few elements on the west side have redundant joints.

Timber Treated ☑ some timbers have been treated with insecticides in 1960s

Other Materials:

Dendrochronology:

dendrochronology done by Anne Crone on timber doors but inconclusive



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joint: rafter and upper beam | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation

Accessibility limitations: The lower beams are beneath the insulation sheets and are therefore inaccessible for inspection

Past interventions: Some rafter ends, close to the walls, reinforced with timbers on the sides bolted together. The sarking is probably not original. In 1960s timber treated for woodworm. 8 years ago redone all the wiring and put partitions for fire safety.

Material Degradation: Fungi attack ☑ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☑

Some humidity stains, but mostly seem old. Some timbers feel wet though. Diffuse insect exit holes on most timbers, probably corresponding to past insect attack confined to the sapwood. Localized insect attack on some timbers. 'Wounds' (injuries suffered by the living tree,) on a few timbers. Fungi attack in a few locations.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage	Disconnection	Unknown	

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient joints
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☑ insect attack
- Past interventions ☐
- Extreme actions ☐
- Other ☐

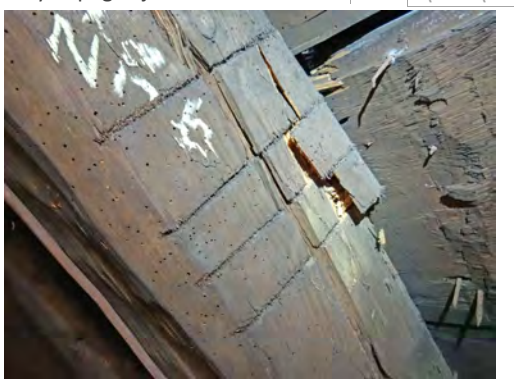
Description of visible damage: Some joints between rafters and upper beams have opened/partly failed, because the timber peg has decayed or broken, or because the mortice or tenon have failed.

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui



Decayed peg in joint | link I:\Arch\A



Insect attack on rafter | link I:\Arch\A



Unidentified fungi attack | link I:\Arch\A



Damage: disconnection | link I:\Arch\A



Damage: disconnection | link I:\Arch\A

DETAILED SURVEY **Building name** HOLYROOD PALACE **Roof location** N range

Survey date(s) 12/02/2016 02/06/2016 15/06/2016 28/06/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings HP-N-1, HP-N-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafters	650*	rectangular with wanes	bending, compression	pinus sylvestris	hand axed
South upper beams	500	rectangular with wanes	bending	pinus sylvestris	hand axed
North upper beams	225	rectangular with wanes	bending	pinus sylvestris	hand axed
South lower beams	635*		bending, tension		not visible
North lower beams	360*		bending, tension		not visible
Struts	270	rectangular with wanes and bark	bending, compression	pinus sylvestris	hand axed
Sprocket Rafters	340	rectangular	bending		hand axed, only a few hand sawn
Sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

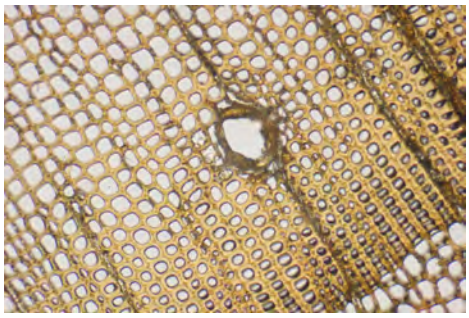
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings HP-N-1, HP-N-2

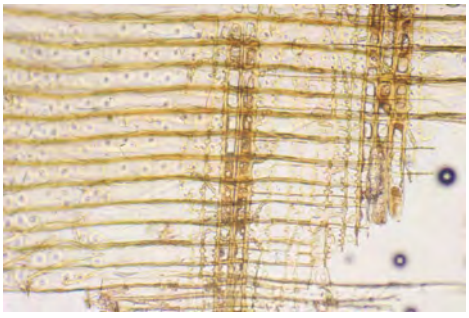
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & upper beam	Encounter mortice & tenon	compression, shear	wooden pegs	quercus sp.
rafter & lower beam	Encounter dovetail	tension	nails	
rafter & strut	Encounter halved	compression, shear	nails	
strut & lower beam	Encounter dovetail	compression, shear	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

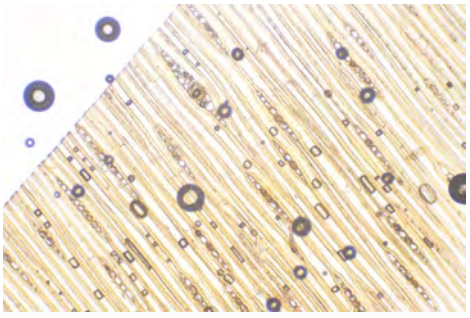
Microscopic identification of the timber species See drawing HP-N-2



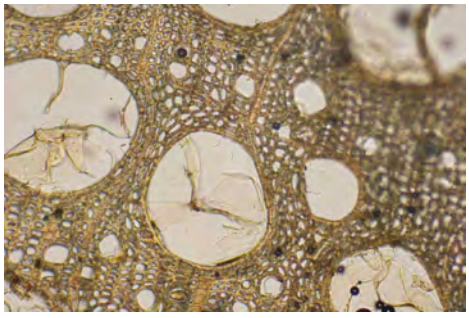
Rafter: transv. section x100 I:\Arc



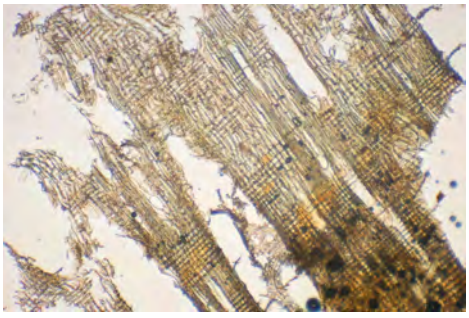
Rafter: radial section x100 I:\Arc



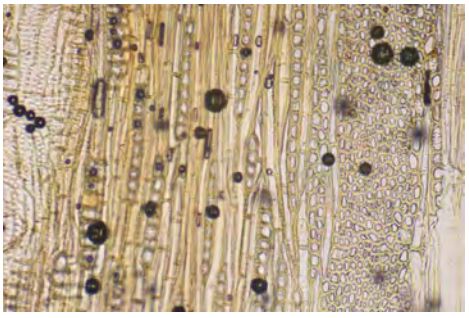
Rafter: tang. Section x50 I:\Arc



Peg: transv. Section x100 I:\Arc



Peg: radial section x50 I:\Arc



Peg: tang. Section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing HP-N-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	Close to frame XXXXV	12/02/2016	11 am	11.7	56.5

roof space	Close to frame XXX	12/02/2016	10:30 am	10.9	59.5
roof space	Close to frame XV	12/02/2016	10 am	11	59.7
roof space	Close to frame XV	02/06/2016	3 pm	21.4	52.5
attic space	Close to frame XLIII on North side	02/06/2016	11:20 am	19	56.8
attic space	Close to frame XLIII on South side	02/06/2016	12 am	22	46.9
attic space	Close to frame XX on North side	02/06/2016	10:40 am	18.9	47
attic space	Close to frame XX on South side	02/06/2016	12:40 pm	20	48.5
attic space	Close to frame X on North side	02/06/2016	10 am	18.9	52
attic space	Close to frame XI on South side	02/06/2016	1:10 pm	19	60
roof space	Close to frame XV	15/06/2016	10 am	16.9	65

Frame/Truss name XX — See drawings HP-N-2, HP-N-9

Missing elements:

Elements with defects in critical area: S rafter

Joints with decayed peg: between N & S upper beam and rafter

Insect attack: N upper beam

Failed joints:

Fungi attack:

Other: 6cm deep check on one side of S rafter

Element name A north upper beam

Dating: original construction

Signs of reuse:

Timber treated: ☑ insecticides, in the 1960s

Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 16.5x14 — min. size (hxb) [cm]: 12.5x13 — Single piece ☑ — Jointed element ☐

Strength affecting defects

Pith location: centre — Slope of grain [%]:

Knots [min d/section h]: — Knotty element ☐ — Defects in critical area ☐ — Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:



insect attack, probably old — I:\Arc

Material degradation

Insect attack ☑ — Type: Anobium Punctatum — Status: non-active

Way of identification: Estimated

Fungi attack ☐ — Type: — Status:

Way of identification:

Corrosion ☐ — Wet surface ☐ — Other:

Mechanical Damage

	Type	Status	Role
Deformation ☐			
Cracks ☐			
Crushing ☐			
Other ☐			

Estimated level of damage: — Emergency interv. needed ☐

Mater.Degr. and Damage Extent: in point A section reduced 8cm in height - in point B section reduced 2cm all around

Way of identification: NDT/SDT, visual inspection

Estimated causes of primary damage

Poor design ☐ — Poor construct. ☐ — Degradation ☐ — Poor maintenance ☐ — Past interv. ☐ — External actions ☐ — Other ☐

Measurement Point a

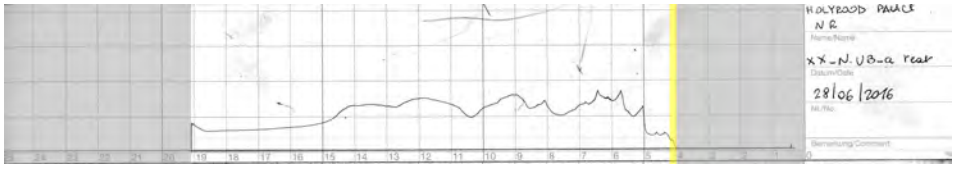
Moisture Content [%]: 14.4 — Visible Material Degradation ☑ — Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: — Higher voltage ☐ — Higher gain ☐ — Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]:

Material Degradation based on Micro-drill [%]: 1.2

Link to Micro-drill graph: I:\Arc



LEGEND — Zero resistanc — Low resistance — High resistance (knot — Out of timber

Measurement Point b

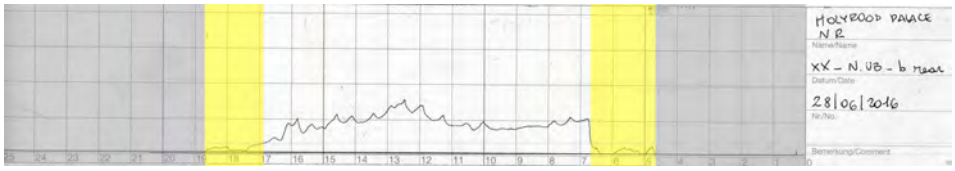
Moisture Content [%] 13.5 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 24.8

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

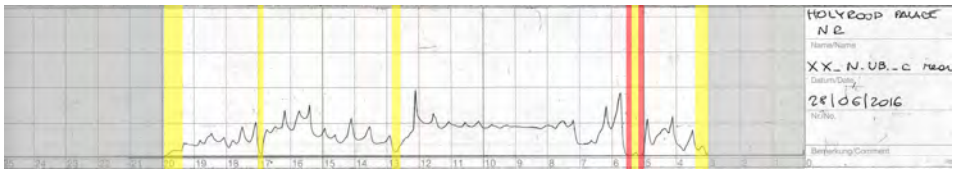
Moisture Content [%] 14.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 2.5

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name XIV — See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg between N upper beam and rafter | Insect attack

Failed joints between N upper beam and rafter | Fungi attack

Other old humidity stain on S upper beam

Connection name between N upper beam and rafter — FrameTrussCode HP-N-XIV

Mechanical Damage:	Type	Status	Role
Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary

Estimated causes of primary damage:

Poor design ☑ wrong geometry | Poor maintenance ☐

External actions ☐ | Material degrad. ☑

Poor construction ☐

Past interventions ☐

Other ☐

Description: decayed peg, completely missing, and joint open



joint open, peg missing | I:\Ar

Estimated damage level severe

Emergency intervention needed ☐

Frame/Truss name XIII — See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints between N upper beam and rafter | Fungi attack

Other small crack in S upper beam

Connection name between N upper beam and rafter — FrameTrussCode HP-N-XIII

Mechanical Damage: Type | Status | Role

Type	Status	Role
Splitting: shear failure along grain ☑	unknown	primary
Crushing: compr. failure across grain ☐		
Disconnection due to shrinkage ☐		
Cracking ☐		
Fixing failure ☐		



joint open, peg undamaged | I:\Ar

Estimated causes of primary damage:

Poor design ☑ wrong geometry
Poor maintenance ☐
External actions ☐
Material degrad. ☑
Poor construction ☐
Past interventions ☐
Other ☐

Description: joint open, probably broken tenon

Estimated damage level: rupture
Emergency intervention needed ☐

Frame/Truss name XII | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between N upper beam and rafter | Insect attack
Failed joints: between N upper beam and rafter | Fungi attack
Other

Connection name between N upper beam and rafter | FrameTrussCode: HP-N-XII

Mechanical Damage: Type | Status | Role

Type	Status	Role
Splitting: shear failure along grain ☐		
Crushing: compr. failure across grain ☐		
Disconnection due to shrinkage ☐		
Cracking ☐		
Fixing failure ☑	unknown	primary



I:\Ar

Estimated causes of primary damage:

Poor design ☑ wrong geometry
Poor maintenance ☐
External actions ☐
Material degrad. ☑
Poor construction ☐
Past interventions ☐
Other ☐

Description: decayed peg and joint open

Estimated damage level: medium
Emergency intervention needed ☐

Frame/Truss name XI | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between S upper beam and rafter | Insect attack
Failed joints | Fungi attack
Other: old humidity stain on S upper beam -S rafter lower end strengthened

Frame/Truss name VIIII | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between N & S upper beam and rafter | Insect attack
Failed joints: between N upper beam and rafter | Fungi attack
Other: old humidity stain on S upper beam - S rafter lower end strengthened

Frame/Truss name VIII | See drawing HP-N-2

Missing elements: S strut | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: old humidity stain on S upper beam - S rafter lower end strengthened

Frame/Truss name VI | See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg: between S upper beam and rafter | Insect attack

Failed joints | Fungi attack: N upper beam

Other

Frame/Truss name X — See drawings HP-N-2, HP-N-4

Missing elements: N strut | Elements with defects in critical area: S strut, S rafter

Joints with decayed peg | Insect attack: N & S upper beam

Failed joints | Fungi attack: N upper beam

Other: N rafter wet close to wall - S rafter lower end strengthened

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: central part not visible

Past interventions: Rafter end close to wall strengthened with additional timber elements on the sides bolted together

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 16.1x13.4 | min. size (hxb) [cm]: 13x11 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 6 | tangential

Knots [min d/section h]: 3.5/14.5 | single | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other



Rafter end strengthened | I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 13.3 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1355 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -0.8

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%] 13.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1543 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -8.1

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 13.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1068 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] 10.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 15.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2391 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -41.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 17.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1596 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -10

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 16.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1819 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -18.8

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B south strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 18.3x14 min. size (hxb) [cm] 14x14 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 2.4/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

	Type	Status	Role
Deformation ☐			
Cracks ☐			
Crushing ☐			
Other ☐			

Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 15
Ultrasonic velocity [m/s]: 1492
Density loss based on ultrasonic test [%]: -5.8
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 14.5
Ultrasonic velocity [m/s]: 1670
Density loss based on ultrasonic test [%]: -12.9
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

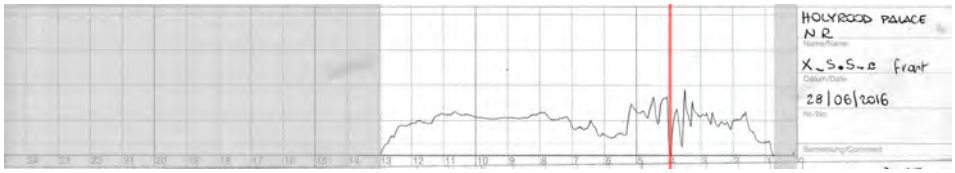
Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 15.2
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]: 0.5
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C south upper beam

Dating: original construction
Signs of reuse
Timber treated ☑: insecticides, in the 1960s
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]: 20.6x19.1 min. size (hxb) [cm]: 19.5x17 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre Slope of grain [%]: 5 tangential
Knots [min d/section h]: 4/20 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



Insect attack, probably old I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status non-active

Way of identification Estimated

Fungi attack ☑ Type Unknown Status unknown

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type		Status	Role
Deformation	☐		
Cracks	☐		
Crushing	☐		
Other	☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 1cm all around - in point D almost half section lost

Way of identification: NDT/SDT

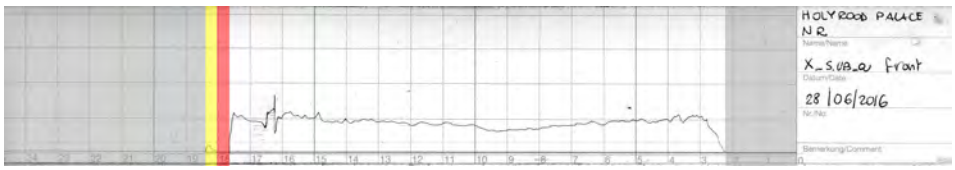
Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 13.8
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%] 4.3
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

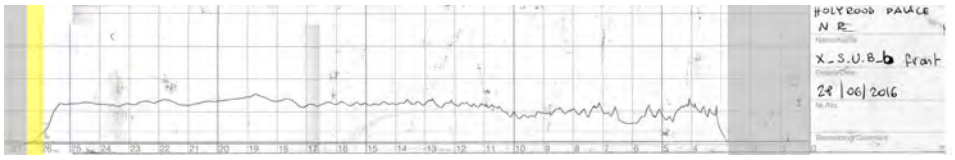


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 14.3
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%] 2.2
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 14.2
Ultrasonic velocity [m/s] 1767
Density loss based on ultrasonic test [%] -16.7
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

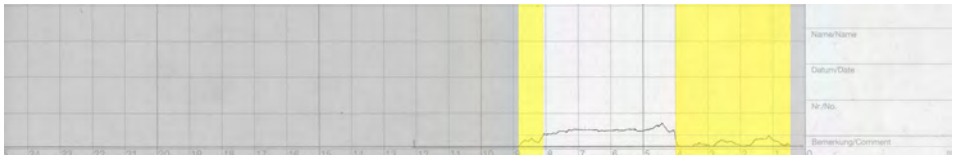
Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 14.1
Ultrasonic velocity [m/s] 1309
Density loss based on ultrasonic test [%] 1.4
Material Degradation based on Micro-drill [%] 41.2
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name D south sprocket rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 15.5x12 | min. size (hxb) [cm]: 15x12 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 2 | tangential

Knots [min d/section h]: 2/15 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ | Type: | Status: | Way of identification:

Fungi attack ☐ | Type: | Status: | Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage | Way of identification: NDT/SDT

Measurement Point a

Moisture Content [%]: 14.6 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1537 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -7.6

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 13.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1330 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: 0.6

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name E north rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 16.8x14.3 | min. size (hxb) [cm]: 15x13 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 5 | tangential

Knots [min d/section h]: 2/15 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 16.1
Ultrasonic velocity [m/s]: 1919
Density loss based on ultrasonic test [%]: -23.5
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

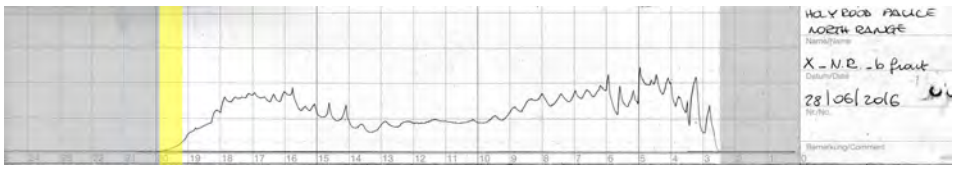
Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 15.4
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 4
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 14.2
Ultrasonic velocity [m/s]: 1908
Density loss based on ultrasonic test [%]: -22.7
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%]: 16.2
Ultrasonic velocity [m/s]: 1712
Density loss based on ultrasonic test [%]: -15.5
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 16.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1517 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -8.1

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1450 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -5.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name F north upper beam

Dating original construction Signs of reuse

Timber treated ☑ insecticides, in the 1960s Accessibilityissues only end close to rafter is visible, the rest is enclosed in a rooflight

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17x9.5 min. size (hxb) [cm] 17x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



Insect attack, probably old I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status non-active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent section reduced 4cm in height at the northern end

Way of identification visual inspection

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☑ | ultrasonic ☑ | micro-drill ☑

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name G north sprocket rafter

Dating: later | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 21.25x11.5 | min. size (hxb) [cm]: 20x11 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 5 | tangential

Knots [min d/section h]: 2/12 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 1cm all around | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

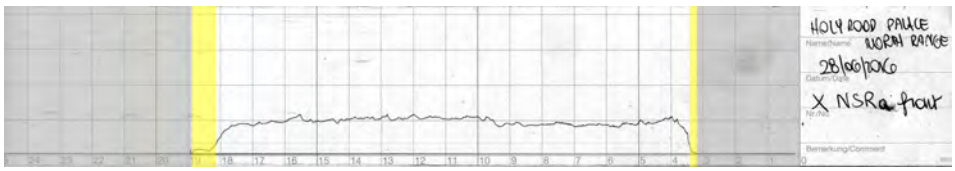
Moisture Content [%]: 14.8 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s]: 1176 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: 5.7

Material Degradation based on Micro-drill [%]: 5.8

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 17.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s]: 2032 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -28.1

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name XXXXVI — See drawings HP-N-2, HP-N-10

Missing elements | Elements with defects in critical area

Joints with decayed peg: between S upper beam and rafter | Insect attack: N rafter & N upper beam

Failed joints | Fungi attack

Other

Element name A north rafter

Dating: original construction | Signs of reuse

Timber treated: ☑ insecticides, in the 1960s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 16.5x14 | min. size (hxb) [cm]: 15x12.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



Insect attack, probably old | I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: non-active | Way of identification: Estimated

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 1-3cm all around - internal decay up to 1cm wide but confined to sapwood | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

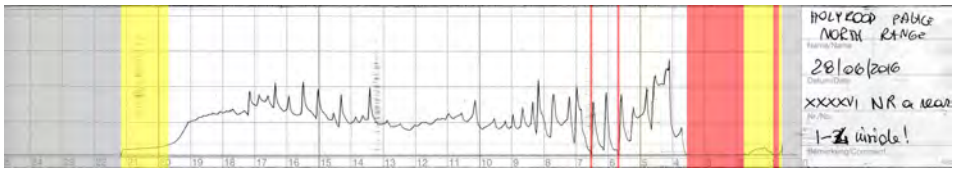
Moisture Content [%]: 13.8 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 21

Link to Micro-drill graph: I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

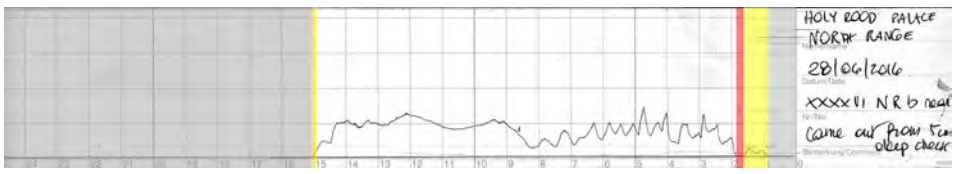
Moisture Content [%]: 15.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 7.5

Link to Micro-drill graph: I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

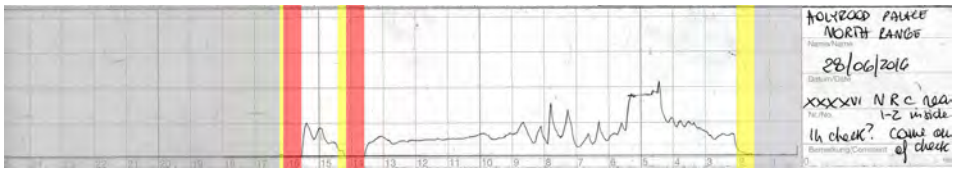
Moisture Content [%] 14.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 13.4

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

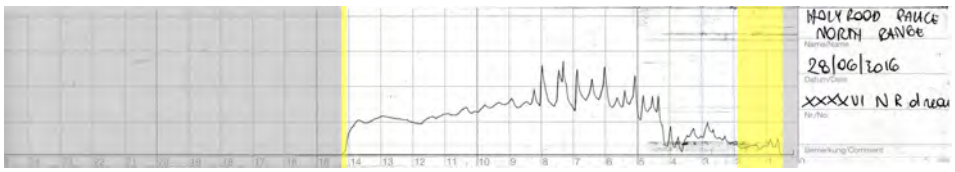
Moisture Content [%] 14 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 9.7

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name B north upper beam

Dating original construction | Signs of reuse

Timber treated ☑ insecticides, in the 1960s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15x12.7 | min. size (hxb) [cm] 13.5x12.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



insect attack, probably old I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum | Status active

Way of identification Estimated

Fungi attack ☐ Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 1cm all around - internal decay up to 1cm wide but confined to sapwood

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

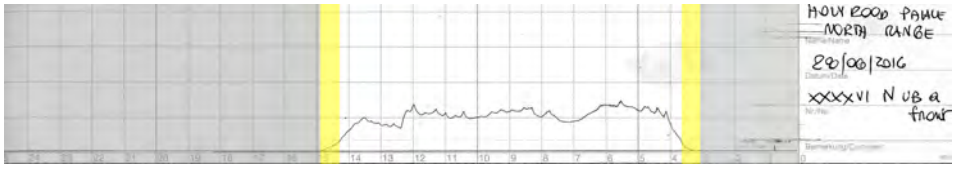
Moisture Content [%] 15.4 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 9.1

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

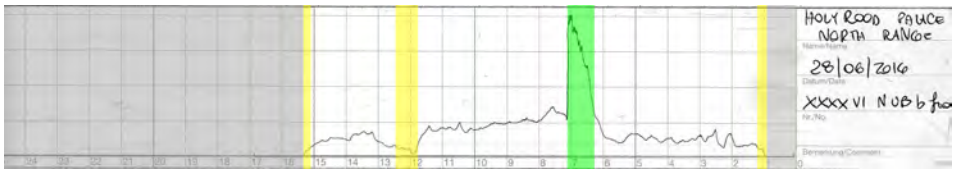
Moisture Content [%] 15.9 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 6.8

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

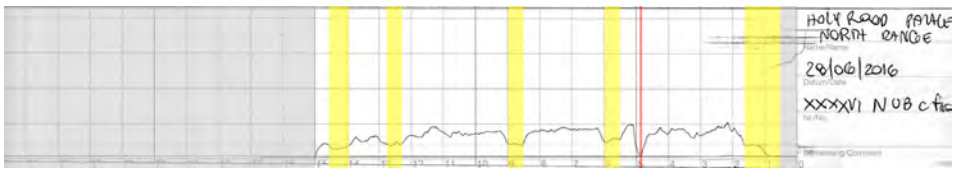
Moisture Content [%] 14.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 13.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Connection name between S upper beam and rafter | FrameTrussCode HP-N-XXXXVI

Mechanical Damage: Type | Status | Role

Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary



insect attack affecting all joint | I:\Ar

Estimated causes of primary damage:

Poor design ☐ | Poor maintenance ☐

External actions ☐ | Material degrad. ☑

Poor construction ☐ | Description: decayed peg

Past interventions ☐

Other ☐

Estimated damage level severe

Emergency intervention needed ☐

Frame/Truss name XXIII | See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other rafters and upper beams different from others: bigger section and one sawn face

Frame/Truss name IIII | See drawings HP-N-2, HP-N-9

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack N rafter

Failed joints | Fungi attack

Other

Element name A north rafter

Dating original construction | Signs of reuse

Timber treated ☑ insecticides in 1960s | Accessibilityissues central part not visible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.7x17.1 | min. size (hxb) [cm] 16x15.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



Insect attack with new bore-dust | I:\Arc

Material degradation

Insect attack ☑ Type: Anobium Punctatum | Status: active | Way of identification: Estimated

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

	Type	Status	Role
Deformation	☐		
Cracks	☐		
Crushing	☐		
Other	☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 2cm all around | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 15.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

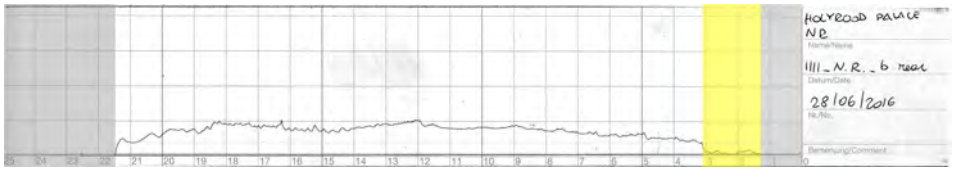
Moisture Content [%]: 17.5 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 8.15

Link to Micro-drill graph: I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%]: 16 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1697 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -14

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

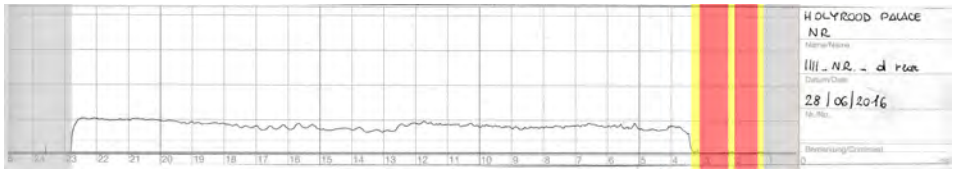
Moisture Content [%]: 15.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 10.5

Link to Micro-drill graph: I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name XXXXIX — See drawings HP-N-2, HP-N-8

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack: S rafter

Failed joints | Fungi attack

Other: additional S strut - S rafter lower end strengthened

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☑ insecticides, in the 1960s | Accessibilityissues

Past interventions: Rafter end close to wall strengthened with additional timber elements on the sides bolted together.

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 15x12.2 | min. size (hxb) [cm]: 14.5x10.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



Insect attack, probably old | I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: non-active

Way of identification: Estimated

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 2cm all around

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

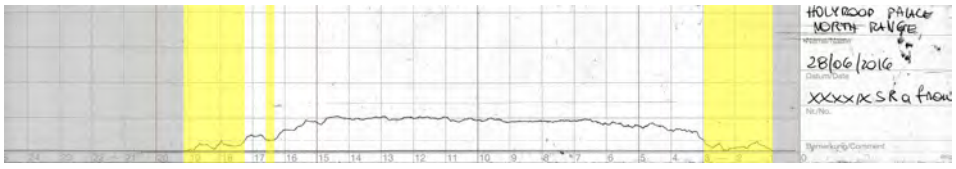
Moisture Content [%]: 13.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 19.8

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 14.3 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1577 | Higher voltage ☑ | Higher gain ☑ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -9.2

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

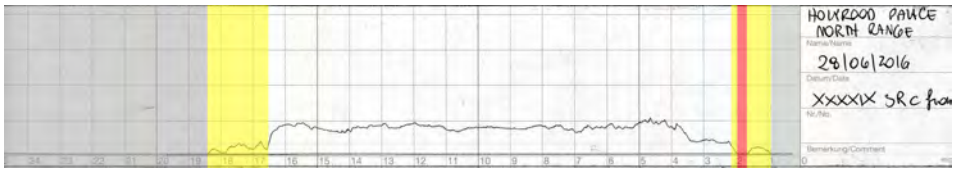
Moisture Content [%] 14.2 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 14.8

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

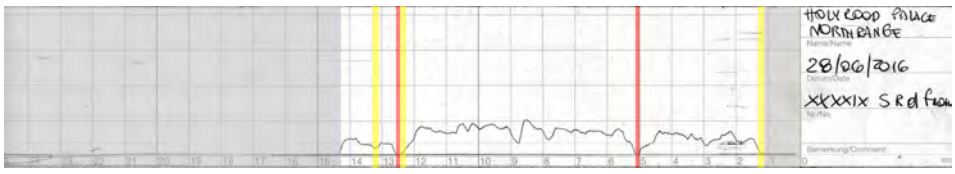
Moisture Content [%] 14 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 5.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Connection name between S upper beam and rafter | FrameTrussCode HP-N-XXXXIX

Mechanical Damage: Type | Status | Role

Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary



decayed peg and tenon | I:\Ar

Estimated causes of primary damage:

Poor design ☐ | Poor maintenance ☐

External actions ☐ | Material degrad. ☑

Poor construction ☐ | Description

Past interventions ☐ | decayed peg and tenon

Other ☐ | Estimated damage level severe

Emergency intervention needed ☐

Frame/Truss name XXII | See drawings HP-N-2, HP-N-8

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack S rafter

Failed joints | Fungi attack

Other 6cm deep check and wound on one side of S upper beam - S rafter strengthened

Element name A south rafter

Dating original construction | Signs of reuse

Timber treated ☑ insecticides, in the 1960s | Accessibilityissues

Past interventions Rafter end close to wall strengthened with additional timber elements on the sides bolted together.

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.3x15.1 | min. size (hxb) [cm] 14.8x14 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☑ Type: Anobium Punctatum Status: active
Way of identification: Estimated

Fungi attack ☐ Type: Status:
Way of identification:

Corrosion ☐ Wet surface ☐ Other:



Insect attack with new bore-dust I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 1-3cm on the sides

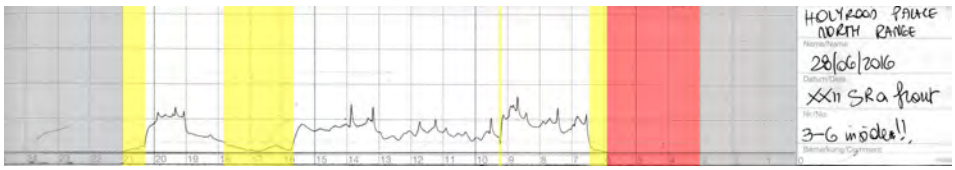
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 13
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 32.6
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

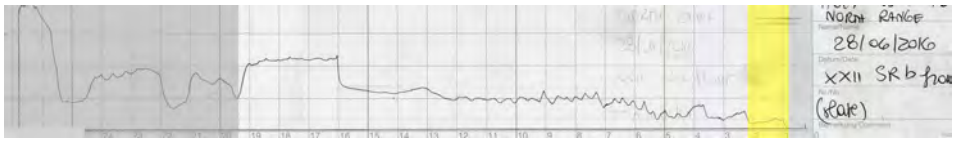


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 15.1
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 5.9
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

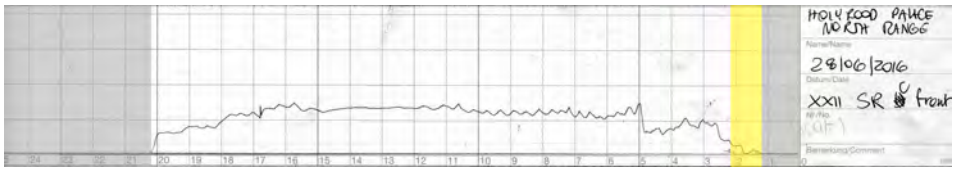


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 13.8
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 4.6
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

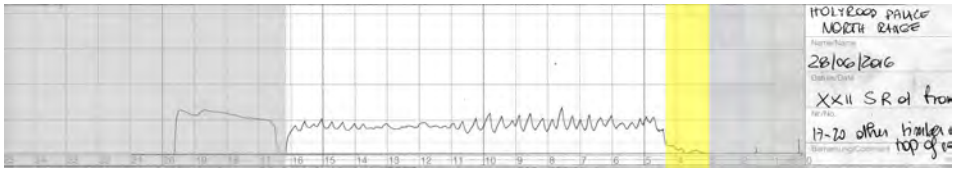


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%]: 13.7
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 9
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B south upper beam

Dating: original construction | Signs of reuse:

Timber treated: ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 17.1x16.9 | min. size (hxb) [cm]: 16.5x16.4 | Single piece: ☑ | Jointed element: ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]:

Knots [min d/section h]: | Knotty element: ☐ | Defects in critical area: ☐ | Deep checks on both sides of element: ☐

Other defects: wound (injury to living tree) and 6cm deep check on one side

Estimated Strength Class according to UNI 11119:



Material degradation

Insect attack: ☐ Type: | Status: | Way of identification:

Fungi attack: ☐ Type: | Status: | Way of identification:

Corrosion: ☐ | Wet surface: ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: | Emergency interv. needed: ☐

Mater.Degr. and Damage Extent: internal decay up to 1cm wide but confined to sapwood

Way of identification: NDT/SDT

Wound (injury to living tree) | I:\Arc

Estimated causes of primary damage

Poor design: ☐ | Poor construct.: ☐ | Degradation: ☐ | Poor maintenance: ☐ | Past interv.: ☐ | External actions: ☐ | Other: ☐

Measurement Point a

Moisture Content [%]: 13 | Visible Material Degradation: ☐ | Not Accessible for: hygrometer: ☐ ultrasonic: ☐ micro-drill: ☐

Ultrasonic velocity [m/s]: 1642 | Higher voltage: ☑ | Higher gain: ☑ | Signal not stable enough to take ultrasonic measur.: ☐

Density loss based on ultrasonic test [%]: -11.8

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

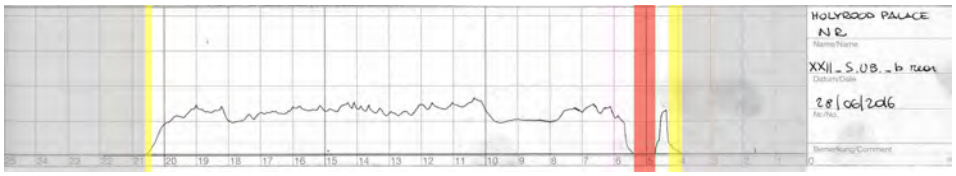
LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 12.4 | Visible Material Degradation: ☐ | Not Accessible for: hygrometer: ☐ ultrasonic: ☐ micro-drill: ☐

Ultrasonic velocity [m/s]: | Higher voltage: ☐ | Higher gain: ☐ | Signal not stable enough to take ultrasonic measur.: ☑

Density loss based on ultrasonic test [%]:



Material Degradation based on Micro-drill [%]: 8.4

Link to Micro-drill graph: I:\Arc

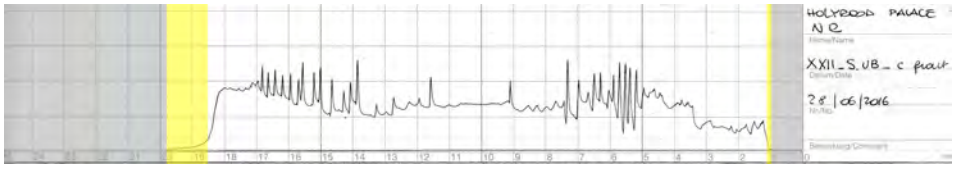
LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%]: 14 | Visible Material Degradation: ☐ | Not Accessible for: hygrometer: ☐ ultrasonic: ☐ micro-drill: ☐

Ultrasonic velocity [m/s]: | Higher voltage: ☐ | Higher gain: ☐ | Signal not stable enough to take ultrasonic measur.: ☑

Density loss based on ultrasonic test [%]:



Material Degradation based on Micro-drill [%]: 6.2

Link to Micro-drill graph: I:\Arc

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

Moisture Content [%] 13 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1861 Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -20.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name XXXXX See drawings HP-N-2, HP-N-7

Missing elements | Elements with defects in critical area

Joints with decayed peg between N upper beam and rafter | Insect attack S upper beam

Failed joints | Fungi attack

Other joint between S rafter and strut more complex than others: dovetail and notched - 6.4cm deeop check on one side of S upper beam

Element name A south upper beam

Dating original construction | Signs of reuse

Timber treated ☑ insecticides, in the 1960s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19.7x18.7 | min. size (hxb) [cm] 19.3x18 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects 6.4cm deep check on one side

Estimated Strength Class according to UNI 11119



insect attack, probably old | I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum | Status non-active | Way of identification Estimated

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 0.5-1.5cm all around - internal decay up to 0.5cm wide but confined to sapwood

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

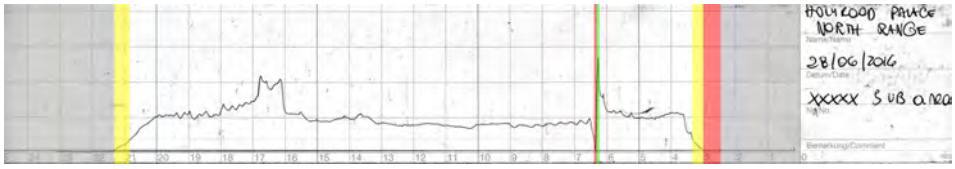
Moisture Content [%] 13.1 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 7.4

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

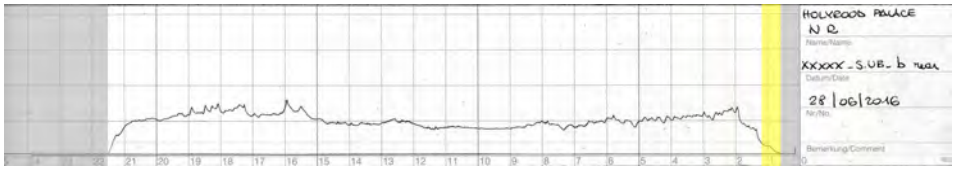
Moisture Content [%] 12.6 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1752 | Higher voltage ☑ | Higher gain ☑ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -16.1

Material Degradation based on Micro-drill [%] 2.3

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

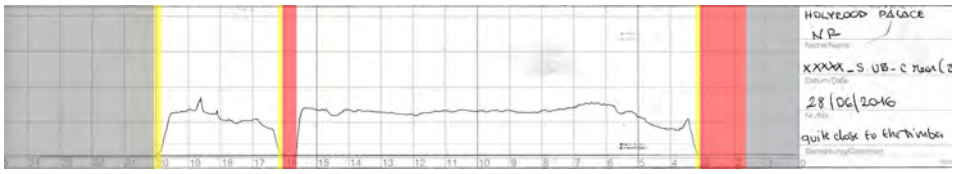
Moisture Content [%] 13.8 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1975 | Higher voltage ☑ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -25

Material Degradation based on Micro-drill [%] 13.3

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

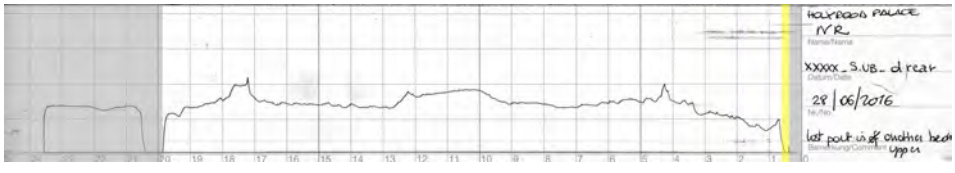
Moisture Content [%] 13.3 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1817 | Higher voltage ☑ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -18.7

Material Degradation based on Micro-drill [%] 1.1

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name XXXXVII | See drawings HP-N-2, HP-N-7

Missing elements S strut | Elements with defects in critical area

Joints with decayed peg | Insect attack N strut & N rafter

Failed joints | Fungi attack

Other redundant dovetail joint on N rafter - S rafter strengthened - efflorescence and wet sarking near N rafter

Element name A north rafter

Dating original construction | Signs of reuse redundant dovetail joint

Timber treated ☑ insecticides, in the 1960s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 18.7x17.2 | min. size (hxb) [cm] 18.5x17 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☑ | Type Anobium Punctatum | Status active

Way of identification Estimated

Fungi attack ☑ | Type Unknown | Status unknown

Way of identification

Corrosion ☐ | Wet surface ☑ | Other efflorescence and wet sarking

Mechanical Damage

Type | Status | Role



Insect attack with new bore-dust I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: no section loss, rot is probably superficial

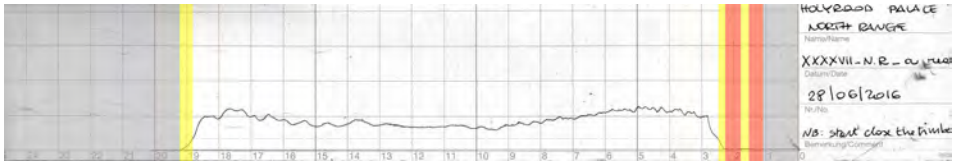
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 19.2
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 9.4
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

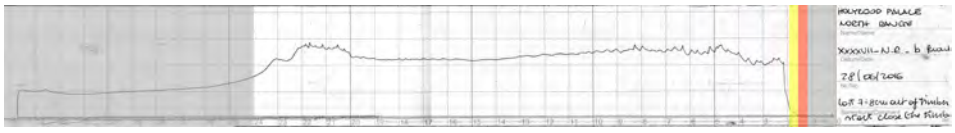


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 17.1
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 3.2
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

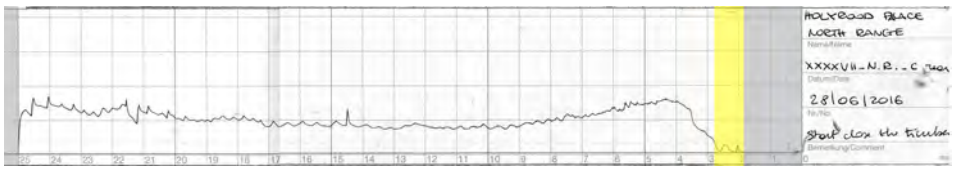


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 15.5
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 3.6
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north strut

Dating: original construction
Signs of reuse:
Timber treated ☑: insecticides, in the 1960s
Accessibilityissues:
Past interventions:
Differences compared to other elements of the same type:
Section: nominal size (hxb) [cm]: 10.6x9.3 min. size (hxb) [cm]: 10x8.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre
Slope of grain [%]:
Knots [min d/section h]:
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☑
Other defects:
Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☑ Type: Anobium Punctatum Status: active
Way of identification: Estimated
Fungi attack ☐ Type: Status:
Way of identification:
Corrosion ☐ Wet surface ☐ Other:

Mechanical Damage

Type Status Role



Insect attack with new bore-dust I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced up to 2cm all round - internal decay up to 1.5cm wide but confined to sapwood

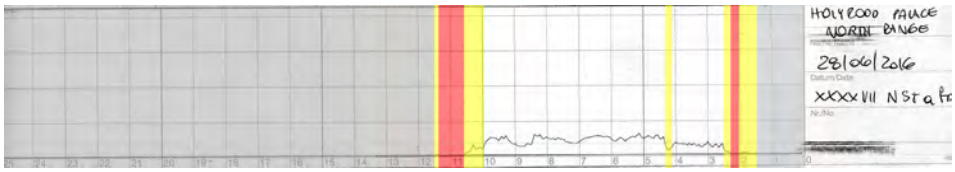
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 15
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]: 24
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

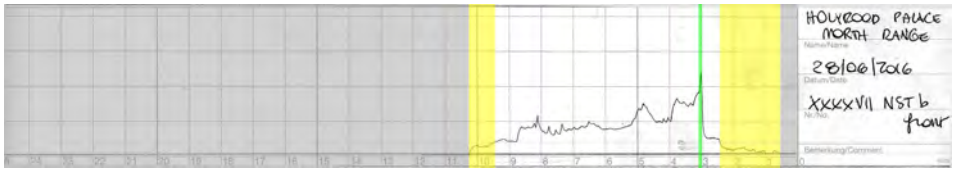


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 14.3
Ultrasonic velocity [m/s]: 1541
Density loss based on ultrasonic test [%]: -7.8
Material Degradation based on Micro-drill [%]: 25
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐

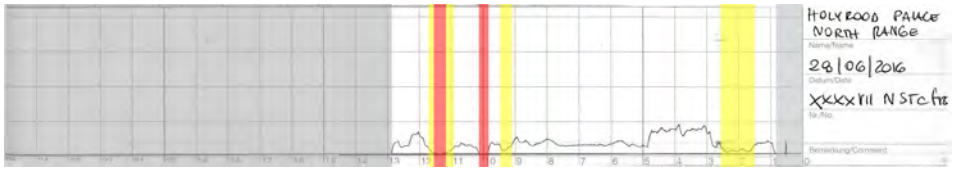


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 15.5
Ultrasonic velocity [m/s]: 1981
Density loss based on ultrasonic test [%]: -25.2
Material Degradation based on Micro-drill [%]: 17
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐

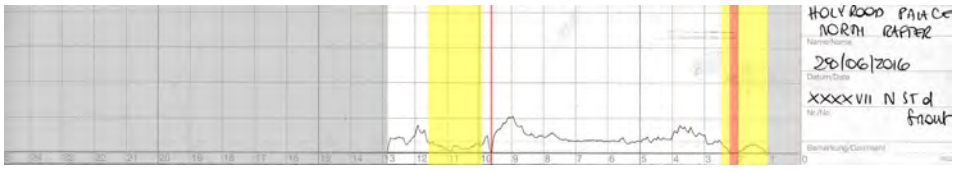


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%]: 16.2
Ultrasonic velocity [m/s]: 2130
Density loss based on ultrasonic test [%]: -31.1
Material Degradation based on Micro-drill [%]: 16.3
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name XLIII — See drawings HP-N-2, HP-N-6

Missing elements
Elements with defects in critical area: N & S struts, S rafter
Joints with decayed peg
Insect attack: N & S struts and S upper beam
Failed joints
Fungi attack: N upper beam

Other: N & S rafter lower ends wet and efflorescence on sarking near their lower end - S rafter lower end strengthened

Element name A south rafter

Dating: original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions: Rafter end close to wall strengthened with additional timber

elements on the sides bolted together.

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.4x13.9 min. size (hxb) [cm] 17x12 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] 2.5/19.5 single Knotty element ☑ Defects in critical area ☑ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



Efflorescence near lower end I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other efflorescence on sarking next to lower end

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 12.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1529 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -7.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 13 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2004 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -26.1

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

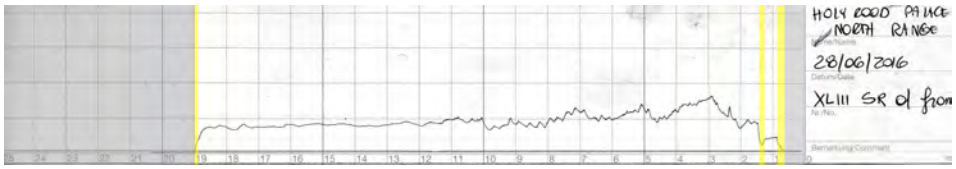
Moisture Content [%] 14.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1261 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] 3.3

Material Degradation based on Micro-drill [%] 2.9

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 14.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1650 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -12.1

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 11.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1886 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -21.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B south strut

Dating original construction Signs of reuse

Timber treated ☑ insecticides, in the 1960s Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.8x9.6 min. size (hxb) [cm] 10.5x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 2.1/11 single Knotty element ☑ Defects in critical area ☑ Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119 lower than III



Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type		Status	Role
Deformation ☐			
Cracks ☐			
Crushing ☐			
Other ☐			

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent internal decay up to 1cm wide and section loss up to 40% (also due to presence of deep checks)

Way of identification NDT/SDT

Insect attack with new bore-dust I:\Arc

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.3 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1461 | Higher voltage ☑ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -4.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

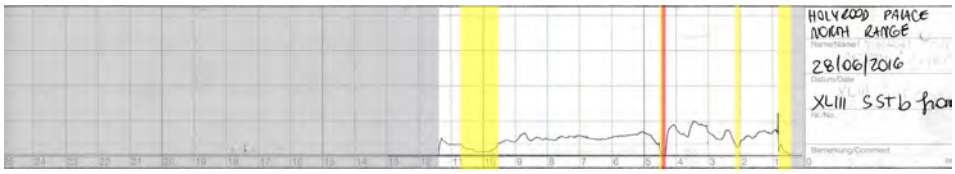
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 14 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1658 | Higher voltage ☑ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -12.4



Material Degradation based on Micro-drill [%] 13.7

Link to Micro-drill graph I:\Arc

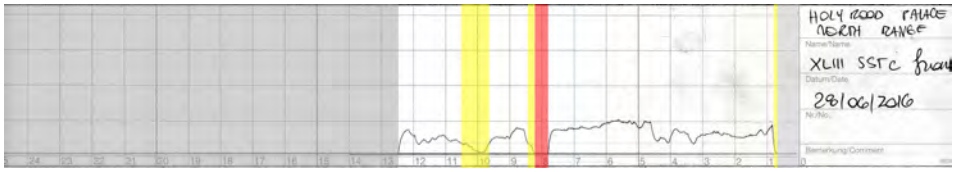
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 15.9 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1708 | Higher voltage ☑ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -14.4



Material Degradation based on Micro-drill [%] 11.6

Link to Micro-drill graph I:\Arc

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C south upper beam

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 16.9x17 | min. size (hxb) [cm] 14.5x14.1 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 12 | tangential

Knots [min d/section h] 8/18.5 | group | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III



Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other Section reduced near wall (4.5cm deep 46cm length)

Section reduced I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2067 Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -28.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 15.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1986 Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -25.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 16 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1965 Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -24.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 17 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2186 Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -33.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name D south sprocket rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.2x11.7 min. size (hxb) [cm] 11x16.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 7 tangential

Knots [min d/section h] 2/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other efflorescence on sarking next to timber

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 17.6
Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Ultrasonic velocity [m/s]: 2361
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]: -40.3
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 17.6
Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Ultrasonic velocity [m/s]: 1689
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]: -13.6
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name E north rafter

Dating: original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]: 20x16 min. size (hxb) [cm]: 15x16.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre Slope of grain [%]: 12 tangential
Knots [min d/section h]: 5/16 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☑ Other: efflorescence on sarking next to timber

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%] 14.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2154 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -32

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2335 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -39.2

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2014 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -26.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2184 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -33.2

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 16.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1926 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -23

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1774 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -17

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name F north strut

Dating original construction Signs of reuse

Timber treated ☑ insecticides, in the 1960s

Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.4x19.5 min. size (hxb) [cm] 12.1x19.1 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 1.3/11.5 single Knotty element ☑ Defects in critical area ☑ Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119 lower than III



Insect attack, probably old I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status non-active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: internal decay up to 2cm wide - in point B half section lost

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

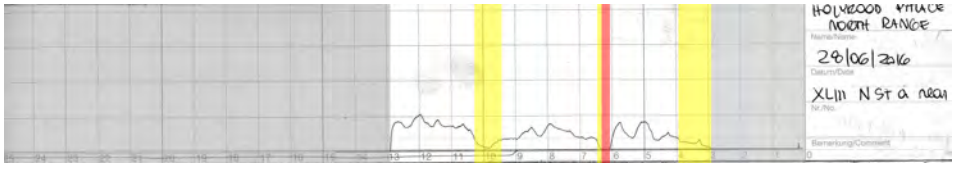
Moisture Content [%] 13.6 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1720 Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -14.9

Material Degradation based on Micro-drill [%] 17.7

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

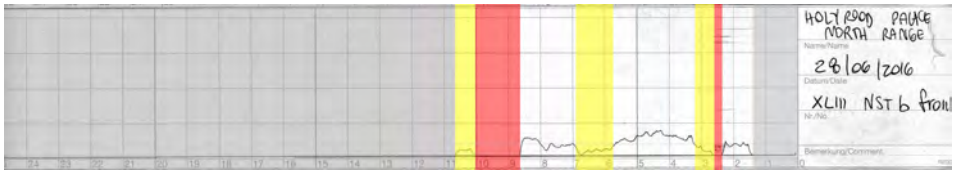
Moisture Content [%] 14.5 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1912 Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -22.5

Material Degradation based on Micro-drill [%] 50.3

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2570 Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -48.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name G north upper beam

Dating original construction Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.7x19.1 | min. size (hxb) [cm] 16.6x19 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 5 | tangential

Knots [min d/section h] 4.3/17.5 | group | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



Fungi attack | I:\Arc

Material degradation

Insect attack ☐ | Type | Status

Way of identification

Fungi attack ☑ | Type Unknown | Status unknown

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: no section loss, fungi attack is probably superficial or at an early stage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

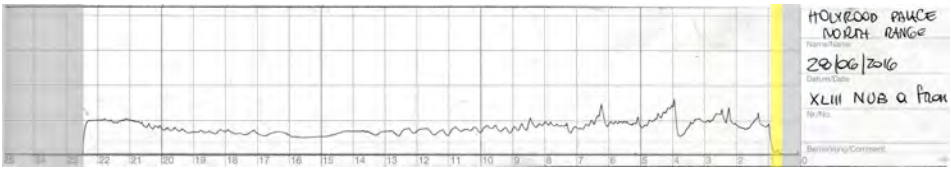
Moisture Content [%] 19.3 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s] 2337 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -39.3

Material Degradation based on Micro-drill [%] 1.7

Link to Micro-drill graph I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

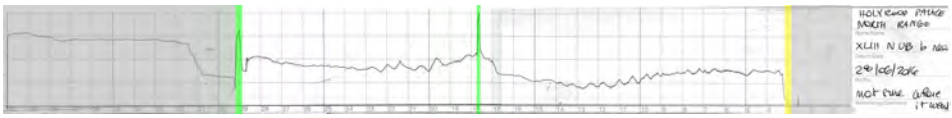
Moisture Content [%] 18.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s] 2208 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -34.2

Material Degradation based on Micro-drill [%] 1.1

Link to Micro-drill graph I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name I north sprocket rafter

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.2x11.7 | min. size (hxb) [cm] 10x18 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 5 | tangential

Knots [min d/section h] 3/12 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 | II

Material degradation

Insect attack ☐ Type | Status

Way of identification

Fungi attack ☐ Type | Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 20

Ultrasonic velocity [m/s]: 1733

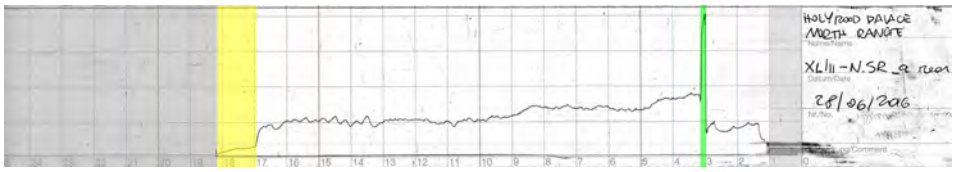
Density loss based on ultrasonic test [%]: -15.4

Material Degradation based on Micro-drill [%]: 6.1

Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 18.6

Ultrasonic velocity [m/s]:

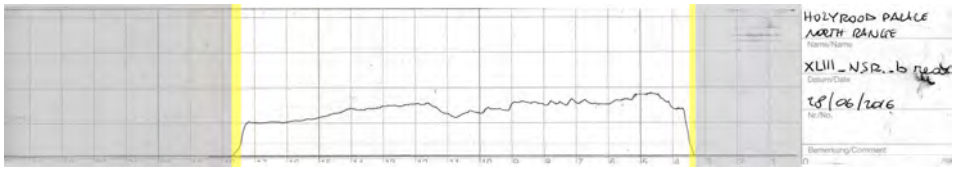
Density loss based on ultrasonic test [%]:

Material Degradation based on Micro-drill [%]: 3.4

Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name XVIIII | See drawings HP-N-2, HP-N-5

Missing elements: S strut

Elements with defects in critical area: S rafter, S upper beam, N strut, N upper beam

Joints with decayed peg: between S upper beam and rafter

Insect attack: N upper beam

Failed joints

Fungi attack

Other: S rafter lower end strengthened

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐

Accessibilityissues

Past interventions: Rafter end close to wall strengthened with additional timber elements on the sides bolted together.

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 18.5x16.6 | min. size (hxb) [cm]: 18x15.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 2 | tangential

Knots [min d/section h]: 4/18 | single

Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



strengthened lower end I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 11.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2148 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -31.8

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 11.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1911 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -22.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 12.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1765 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -16.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 11.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1926 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -23

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 14.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2084 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -29.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 14.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2246 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -35.7

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B south upperbeam

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.4x16.4 min. size (hxb) [cm] 16x16 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 12 tangential

Knots [min d/section h] 4.5/18 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 1-3cm all around

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

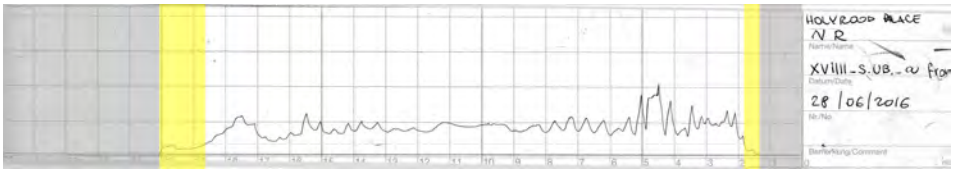
Moisture Content [%] 13.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 8.1

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

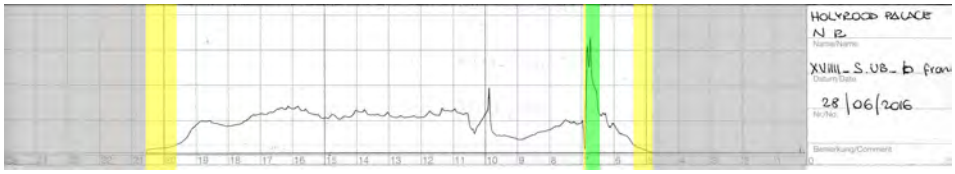
Moisture Content [%] 13.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 9.5

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

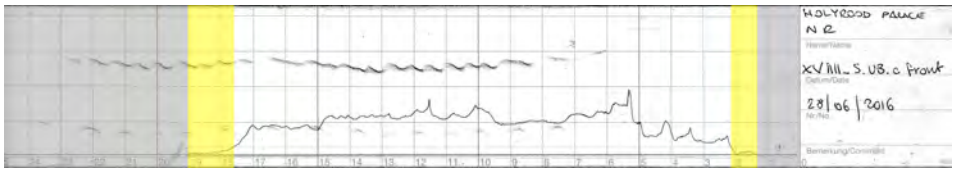
Moisture Content [%] 13.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 11.9

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

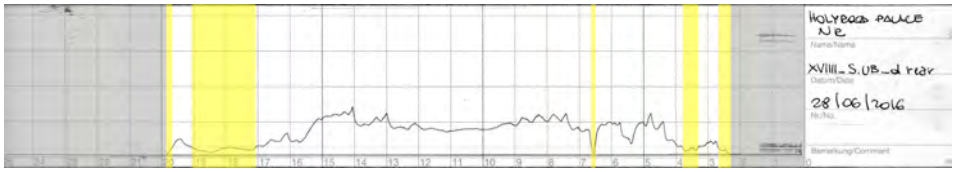
Moisture Content [%] 15.6 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 14.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name C south sprocket rafter

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 14.8x10.5 | min. size (hxb) [cm] 13.5x10 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 5 | tangential

Knots [min d/section h] 2.5/14 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status

Way of identification

Fungi attack ☐ Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1458 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -4.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1502 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -6.2

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name D north rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.5x15.9 min. size (hxb) [cm] 16.5x15 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 8 tangential

Knots [min d/section h] 3/16.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1966 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -24.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2836 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -59

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 15.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2342 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -39.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 17.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1619 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -10.9

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1876 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -21

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1747 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -16

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name E north strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12x10.7 min. size (hxb) [cm] 11x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 6/12 group Knotty element ☑ Defects in critical area ☑ Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage Emergency interv. needed ☐

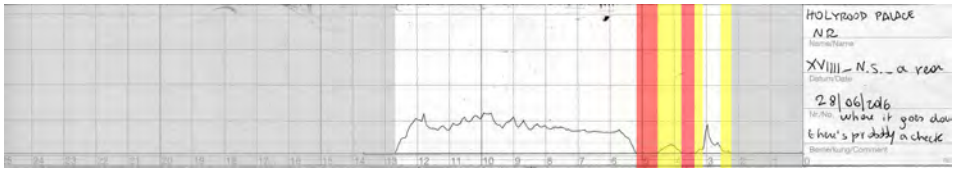
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Mater.Degr. and Damage Extent: internal decay up to 2cm wide but confined to sapwood
Way of identification: NDT/SDT

Measurement Point a

Moisture Content [%]: 15.7
Ultrasonic velocity [m/s]: 1338
Density loss based on ultrasonic test [%]: 0.3
Material Degradation based on Micro-drill [%]: 20.8
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 15.3
Ultrasonic velocity [m/s]: 1629
Density loss based on ultrasonic test [%]: -11.3
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 14.9
Ultrasonic velocity [m/s]: 1848
Density loss based on ultrasonic test [%]: -19.9
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name F north upper beam

Dating: original construction
Signs of reuse
Timber treated ☑: insecticides, in the 1960s
Past interventions
Accessibilityissues: one face is close to the wall and is not well visible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]: 19.2x18.5 min. size (hxb) [cm]: 18.5x18 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre Slope of grain [%]: 6 tangential
Knots [min d/section h]: 3/17 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type		Status	Role
Deformation	☐		
Cracks	☐		
Crushing	☐		
Other	☐		

Estimated level of damage

Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced 3cm on one side and internal decay up to 1cm wide

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 15.6

Ultrasonic velocity [m/s]

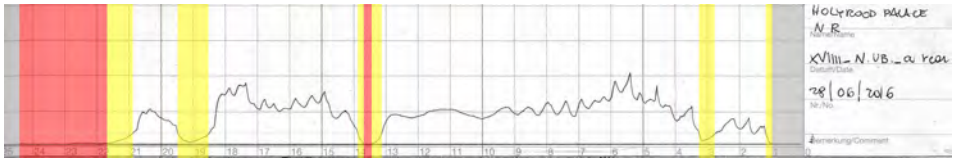
Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%] 23.6

Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]

Ultrasonic velocity [m/s]

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name G north sprocket rafter

Dating later Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 20x8.5 min. size (hxb) [cm] 19.5x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 4 tangential

Knots [min d/section h] 2/20 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 | I

Material degradation

Insect attack ☐ Type | Status

Way of identification

Fungi attack ☐ Type | Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 17.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1463 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -4.7

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

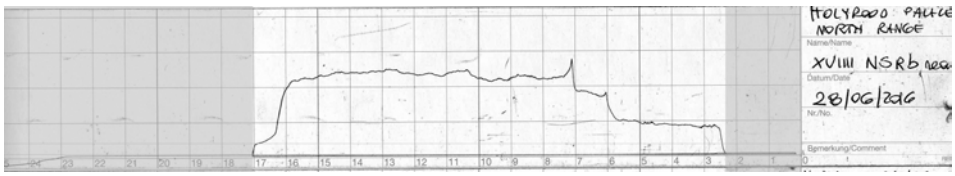
Moisture Content [%]: 18.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1705 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -14.3

Material Degradation based on Micro-drill [%]: 0

Link to Micro-drill graph: I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name XLII | See drawings HP-N-2, HP-N-10

Missing elements | Elements with defects in critical area: N strut

Joints with decayed peg | Insect attack: N strut

Failed joints | Fungi attack

Other: S rafter lower end strengthened - efflorescence on sarking close to upper end of N rafter

Element name A north strut

Dating: original construction | Signs of reuse

Timber treated ☑: insecticides, in the 1960s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 11.3x9 | min. size (hxb) [cm]: 11x8.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119



insect attack, probably old | I:\Arc

Material degradation

Insect attack ☑ Type: Anobium Punctatum | Status: non-active
Way of identification: Estimated

Fungi attack ☐ Type | Status
Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: section reduced up to 40%, not only superficiallly (also due to the presence of deep checks)

Way of identification: NDT/SDT

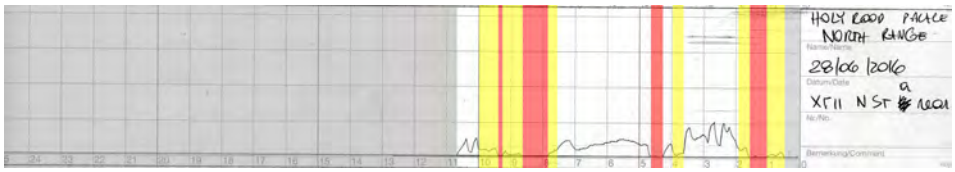
Estimated causes of primary damage

Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 16.2
Ultrasonic velocity [m/s]: 1618
Density loss based on ultrasonic test [%]: -10.8
Material Degradation based on Micro-drill [%]: 40.3
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐

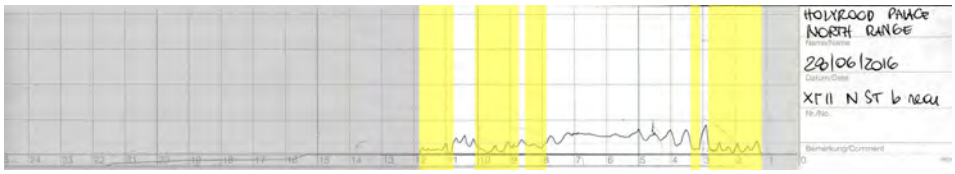


LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 14.9
Ultrasonic velocity [m/s]: 1816
Density loss based on ultrasonic test [%]: -18.7
Material Degradation based on Micro-drill [%]: 32.3
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

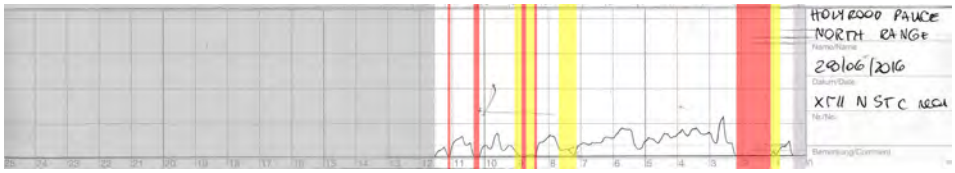


LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%]: 16
Ultrasonic velocity [m/s]: 1796
Density loss based on ultrasonic test [%]: -17.9
Material Degradation based on Micro-drill [%]: 24.2
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

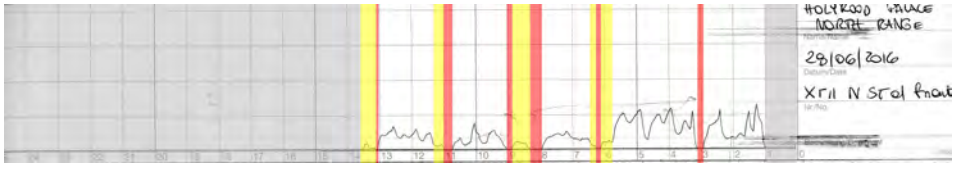


LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

Moisture Content [%]: 15.7
Ultrasonic velocity [m/s]: 1577
Density loss based on ultrasonic test [%]: -9.2
Material Degradation based on Micro-drill [%]: 6.8
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name XXXII — See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg: between N & S upper beam and rafter | Insect attack

Failed joints | Fungi attack

Other

Frame/Truss name not visible 1 — See drawing HP-N-2

Missing elements: S strut | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other: S rafter lower end strengthened - additional S strut

Frame/Truss name XXXXV — See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other: S upper beam partially strengthened

Frame/Truss name XXXXIV — See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg: between N upper beam and rafter | Insect attack

Failed joints | Fungi attack

Other: S rafter lower end reinforced and efflorescence on sarking next to it

Frame/Truss name XLI — See drawing HP-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg: between N upper beam and rafter | Insect attack

Failed joints | Fungi attack: S upper beam

Other: S rafter strengthened and efflorescence on sarking close to its lower end

Element name south upper beam

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



Material degradation

Insect attack ☐ | Type | Status

Way of identification

Fungi attack ☑ | Type: Unknown | Status: unknown

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role: unidentified fungi | I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: Probably superficial

Way of identification: visual inspection

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Frame/Truss name LX — See drawing HP-N-2

Missing elements
Elements with defects in critical area
Joints with decayed peg: between N upper beam and rafter
Insect attack
Failed joints
Fungi attack
Other: S rafter and upper beam twisted - S rafter lower end strenghtened - efflorescence on sarking near S rafter lower end

Frame/Truss name XXXIX — See drawing HP-N-2

Missing elements
Elements with defects in critical area
Joints with decayed peg: between N & S upper beam and rafter
Insect attack
Failed joints
Fungi attack
Other: wound on S upper beam

Connection name between S upper beam and rafter — FrameTrussCode: HP-N-XXXIX

Mechanical Damage: Type / Status / Role

Type	Status	Role
Splitting: shear failure along grain ☐		
Crushing: compr. failure across grain ☐		
Disconnection due to shrinkage ☐		
Cracking ☐		
Fixing failure ☑	unknown	primary

Estimated causes of primary damage:
Poor design ☐
External actions ☐
Poor construction ☐
Past interventions ☐
Other ☑ hammering
Poor maintenance ☐
Material degrad. ☐

Description: broken peg



peg broken due to hammering | I:\Ar

Estimated damage level: rupture
Emergency intervention needed ☐

Frame/Truss name XXXVIII — See drawing HP-N-2

Missing elements
Elements with defects in critical area
Joints with decayed peg: between N upper beam and rafter
Insect attack
Failed joints: between S upper beam and rafter
Fungi attack
Other

Connection name between S upper beam and rafter — FrameTrussCode: HP-N-XXXVIII

Mechanical Damage: Type | Status | Role

Splitting: shear failure along grain	☑	unknown	primary
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☐		



open joint, peg too short | I:\Ar

Estimated causes of primary damage:

Poor design ☑ fastener too small
Poor maintenance ☐
External actions ☐
Material degrad. ☑
Poor construction ☐
Past interventions ☐
Other ☐

Description: joint open probably because peg is too short

Estimated damage level: rupture
Emergency intervention needed ☐

Frame/Truss name XV | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between S upper beam and rafter | Insect attack
Failed joints | Fungi attack
Other

Frame/Truss name XXXV | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between N upper beam and rafter | Insect attack
Failed joints | Fungi attack
Other: new S strut

Frame/Truss name XXI | See drawing HP-N-2

Missing elements | Elements with defects in critical area: S rafter
Joints with decayed peg: between S upper beam and rafter | Insect attack
Failed joints | Fungi attack
Other: 8cm deep check on one side of S rafter

Connection name between S upper beam and rafter | FrameTrussCode: HP-N-XXI

Mechanical Damage: Type | Status | Role

Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	unknown



broken peg | I:\Ar

Estimated causes of primary damage:

Poor design ☐
Poor maintenance ☐
External actions ☐
Material degrad. ☑
Poor construction ☐
Past interventions ☐
Other ☐

Description: broken peg

Estimated damage level: rupture
Emergency intervention needed ☐

Frame/Truss name XXXI | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between N upper beam and rafter | Insect attack
Failed joints | Fungi attack
Other

Frame/Truss name XXX | See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: new S strut and additional vertical pole to support rooflight

Frame/Truss name XXVIIII — See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: old humidity stains on N upper beam - new S strut and additional vertical pole to support rooflight

Frame/Truss name XXVIII — See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: new S strut and additional vertical pole to support rooflight

Frame/Truss name IIVXX — See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: new S strut

Frame/Truss name XXVI — See drawing HP-N-2

Missing elements | Elements with defects in critical area: S rafter
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: 8cm deep check on one side of S rafter

Frame/Truss name XXIIII — See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: S upper beam slightly wet

Frame/Truss name XVI — See drawing HP-N-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack: N rafter
Other

Element name A north rafter

Dating: original construction | Signs of reuse
Timber treated ☐ | Accessibilityissues
Past interventions
Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location | Slope of grain [%] | Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☑ Type: Unknown | Status: unknown | Way of identification

Corrosion ☐ | Wet surface ☐ | Other



fungi attack unidentified | I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Frame/Truss name XXXVII | See drawing HP-N-2

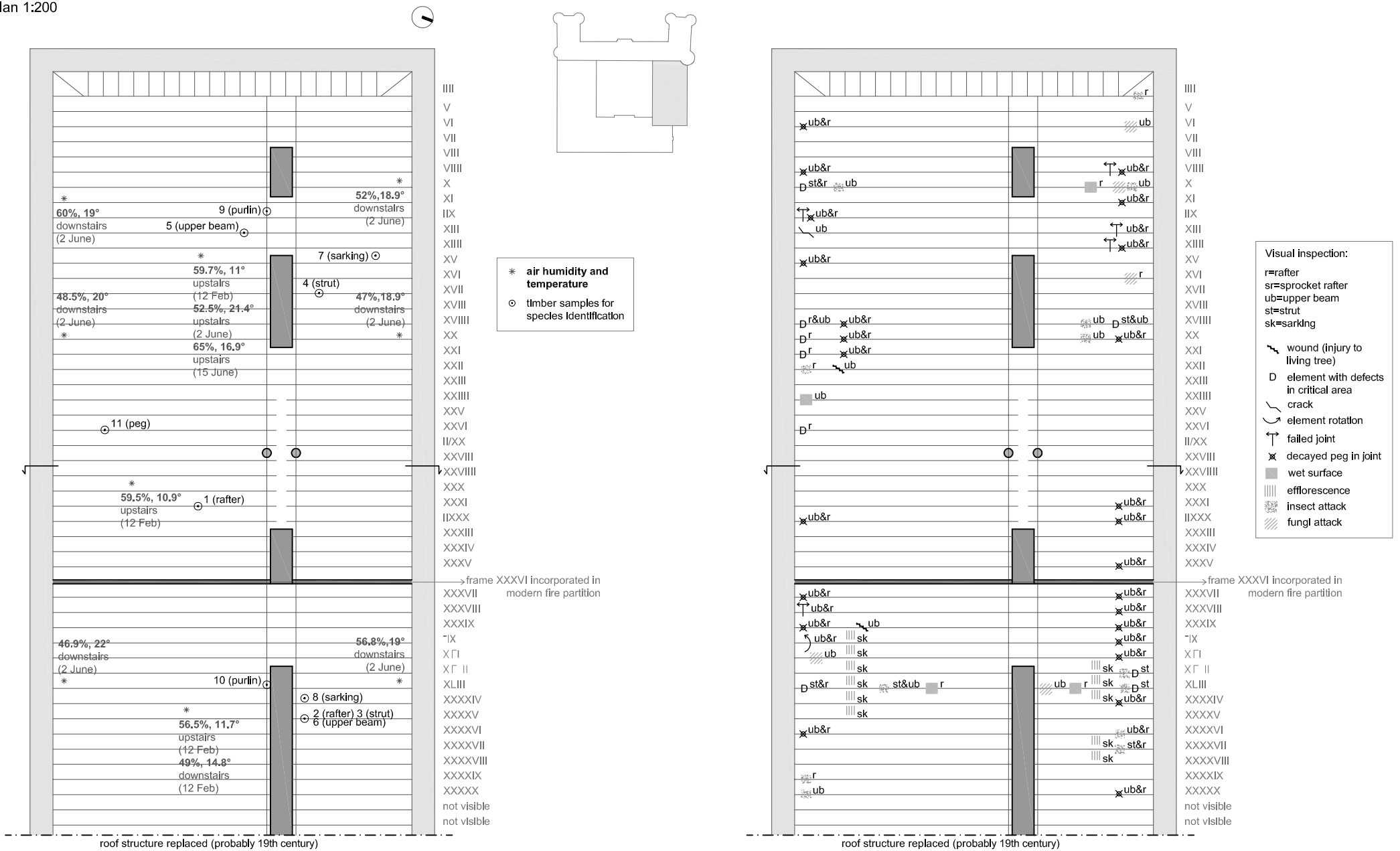
Missing elements | Elements with defects in critical area

Joints with decayed peg: between N & S upper beam and rafter | Insect attack

Failed joints | Fungi attack

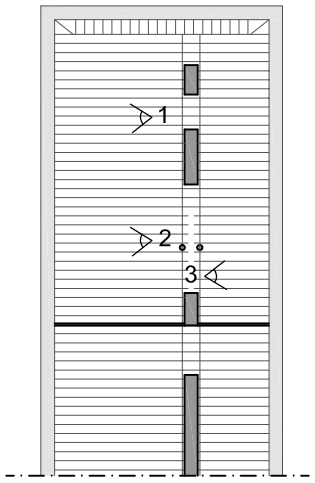
Other

Plan 1:200


60%, 19° downstairs (2 June)
9 (purlin)
5 (upper beam)
52%,18.9° downstairs (2 June)
7 (sarking)
59.7%, 11° upstairs (12 Feb)
4 (strut)
48.5%, 20° downstairs (2 June)
52.5%, 21.4° upstairs (2 June)
47%,18.9° downstairs (2 June)
65%, 16.9° upstairs (15 June)
11 (peg)
59.5%, 10.9° upstairs (12 Feb)
1 (rafter)
46.9%, 22° downstairs (2 June)
56.8%,19° downstairs (2 June)
10 (purlin)
8 (sarking)
2 (rafter) 3 (strut) 6 (upper beam)
56.5%, 11.7° upstairs (12 Feb)
49%, 14.8° downstairs (12 Feb)
air humidity and temperature
timber samples for species identification
IIII V VI VII VIII VIIII X XI IIX XIII XIIII XV XVI XVII XVIII XVIIII XX XXI XXII XXIII XXIIII XXV XXVI II/XX XXVIII XXVIIII XXX XXXI IIXXX XXXIII XXXIV XXXV
frame XXXVI incorporated in modern fire partition
XXXVII XXXVIII XXXIX XL XLI XLII XLIII XXXXIV XXXXV XXXXVI XXXXVII XXXXVIII XXXXIX XXXXX not visible not visible
roof structure replaced (probably 19th century)
ub&r ub st&r st&ub r&ub sk
Visual inspection:
r=rafter
sr=sprocket rafter
ub=upper beam
st=strut
sk=sarking
wound (injury to living tree)
D element with defects in critical area
crack
element rotation
failed joint
decayed peg in joint
wet surface
efflorescence
insect attack
fungi attack
0 1 5

Themographic images

Plan 1:500



1: areas with higher temperature reveal where the insulation sheets are missing and therefore the heat come up from the attic spaces



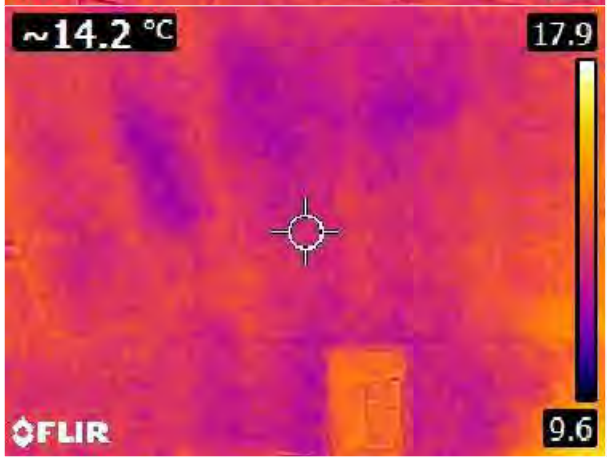


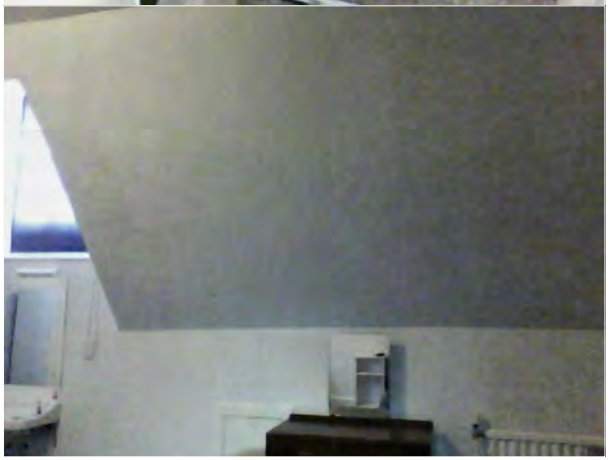
2: areas with higher temperature reveal where the insulation sheets are missing and therefore the heat comes up from the attic spaces





3: areas with higher temperature show the position of the rafters behind the plaster in the attic spaces

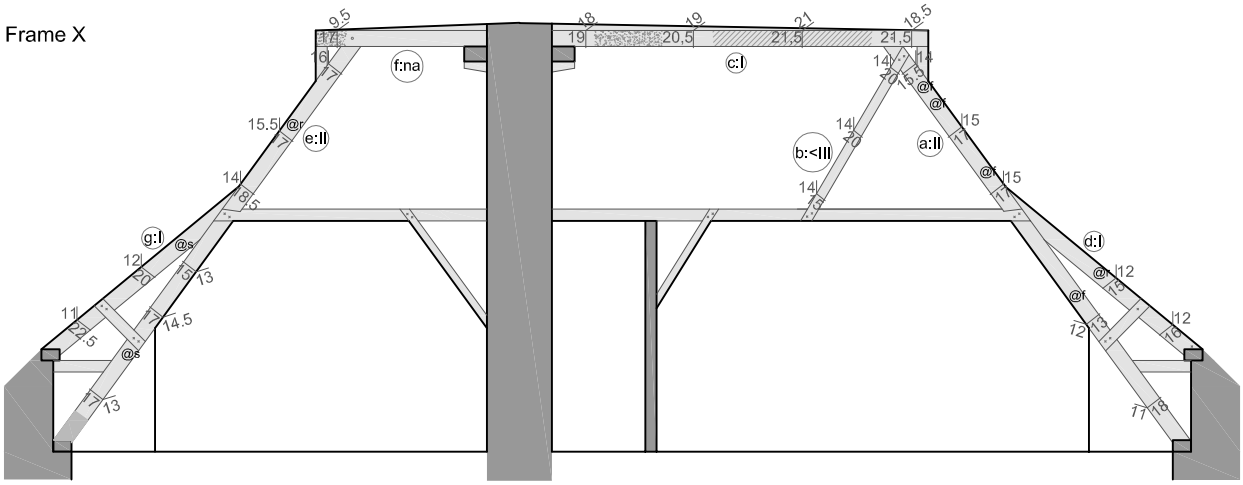


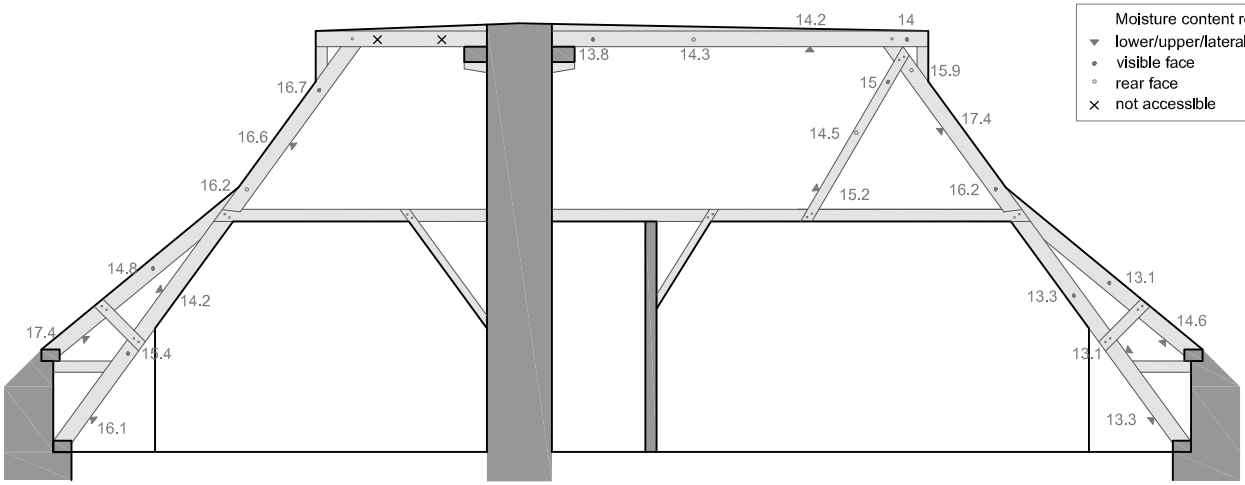


Sections 1:100 (looking East)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (Injury to living tree)
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

Frame X



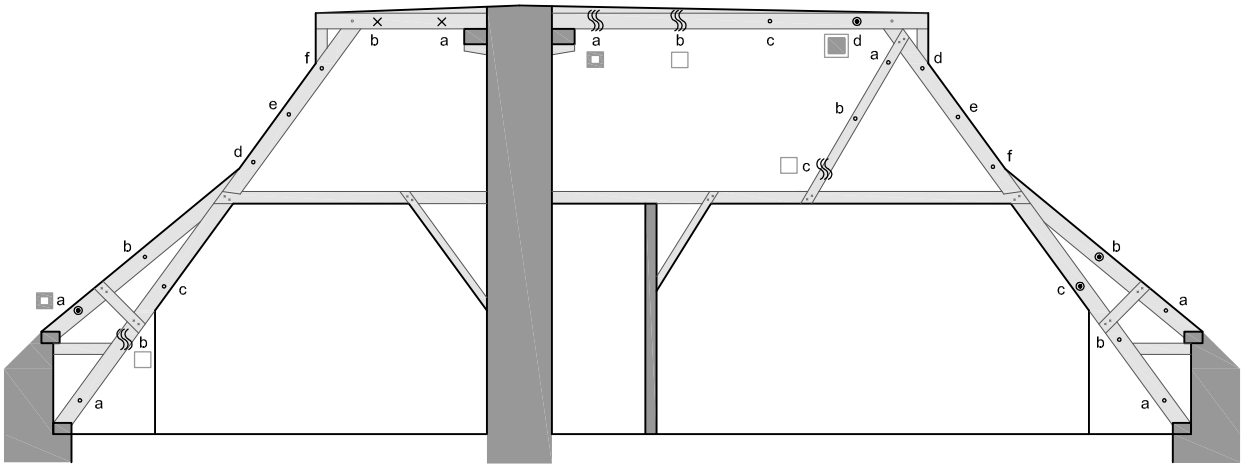


Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & Int. decay
- extensive decay

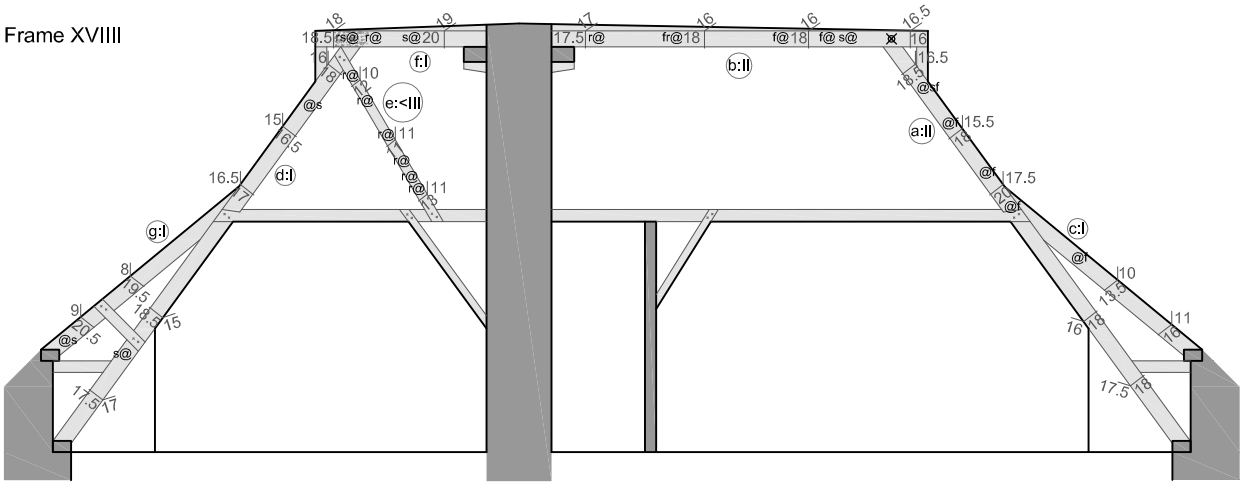


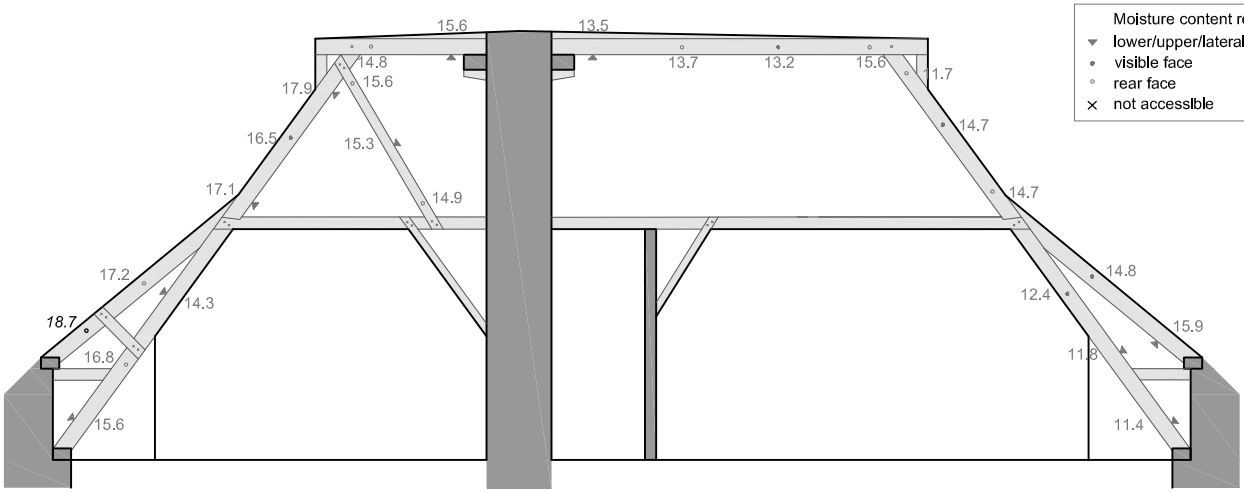
0 1 5

Sections 1:100 (looking East)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (Injury to living tree)
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

Frame XVIIII



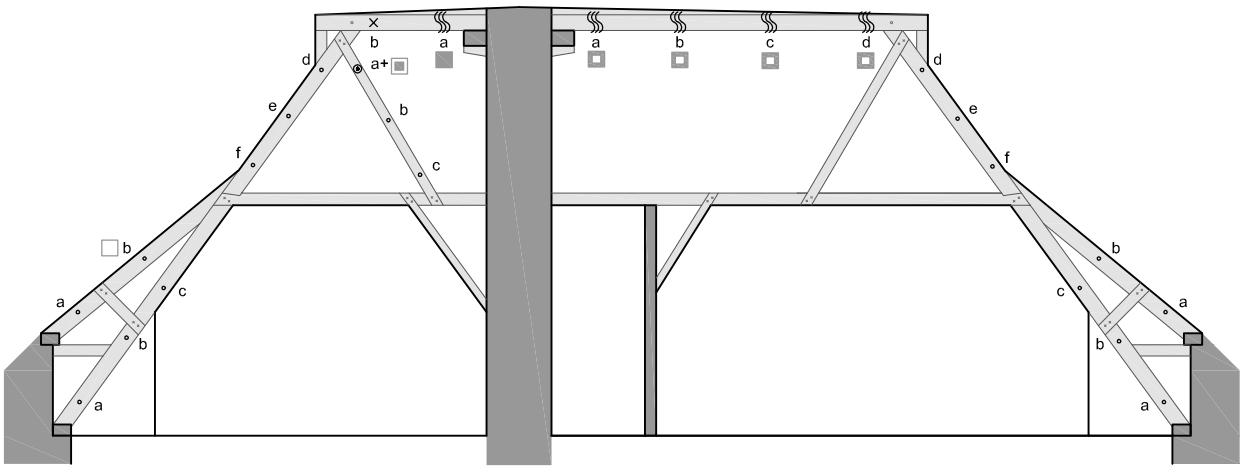


Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & Int. decay
- extensive decay

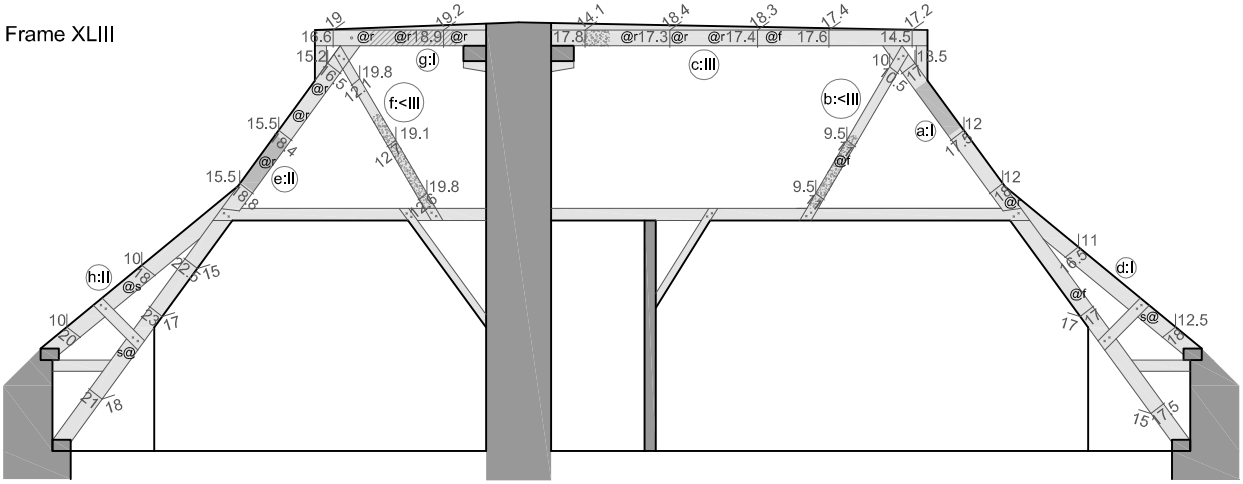


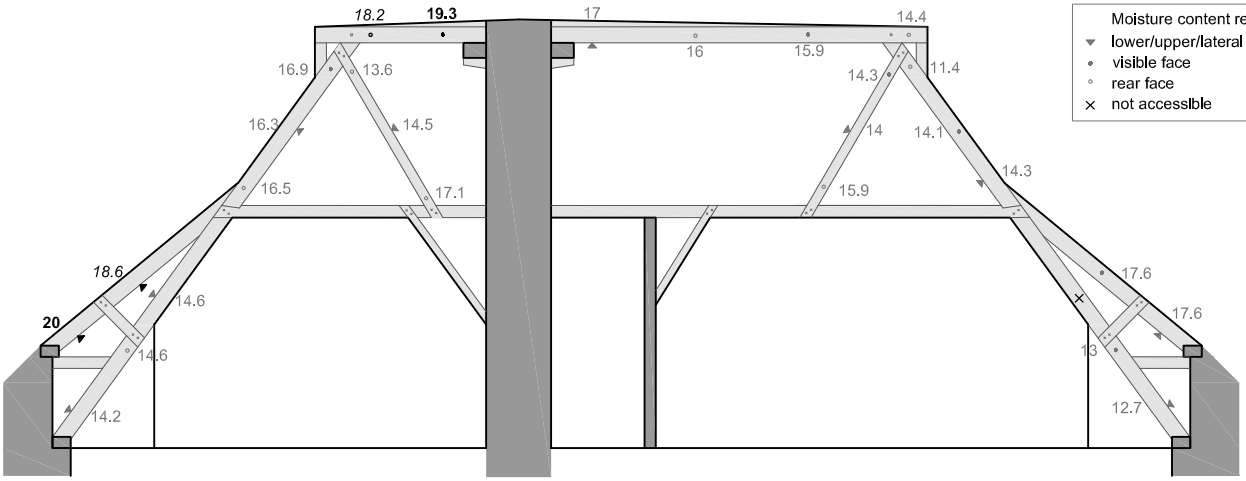
0 1 5

Sections 1:100 (looking East)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (Injury to living tree)
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

Frame XLIII



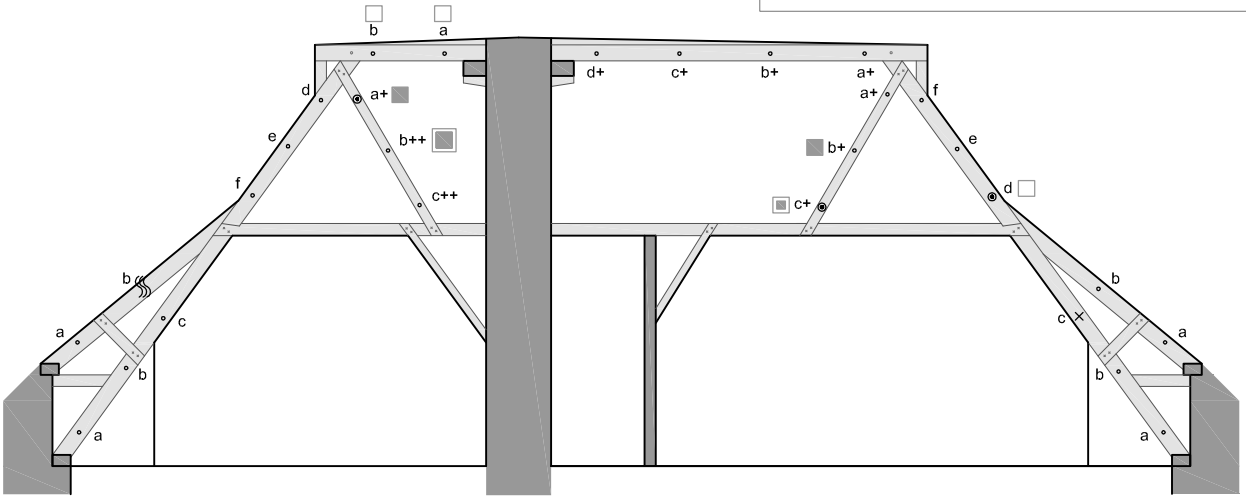


Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & Int. decay
- extensive decay



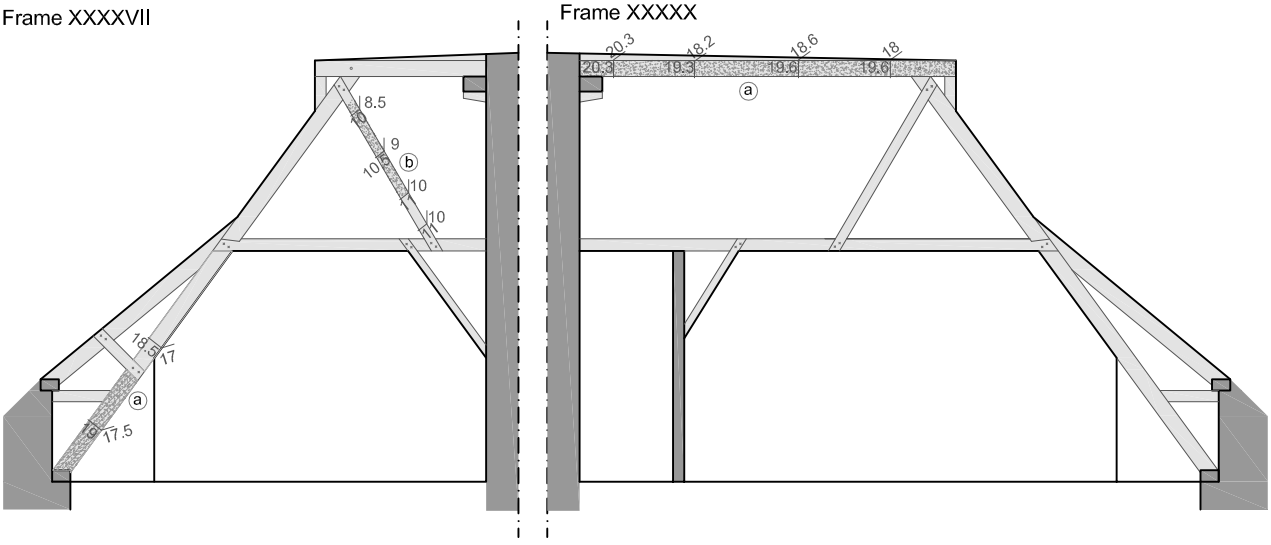
0 1 5

Sections 1:100 (looking East)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (Injury to living tree)
- crack
- element rotation
- open joint
- (x) element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

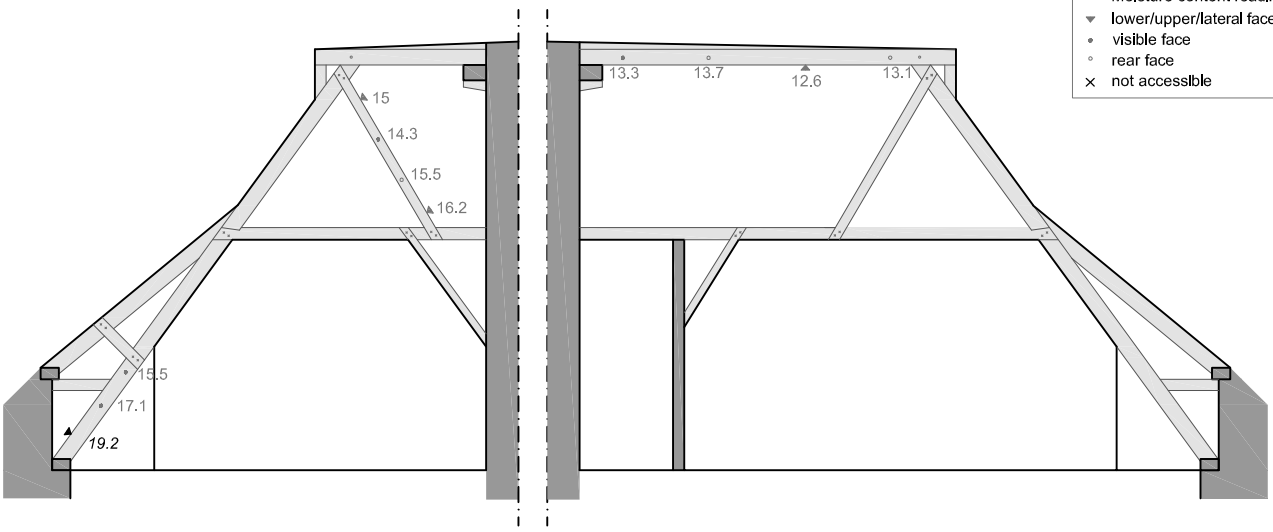
Frame XXXXVII

Frame XXXXX



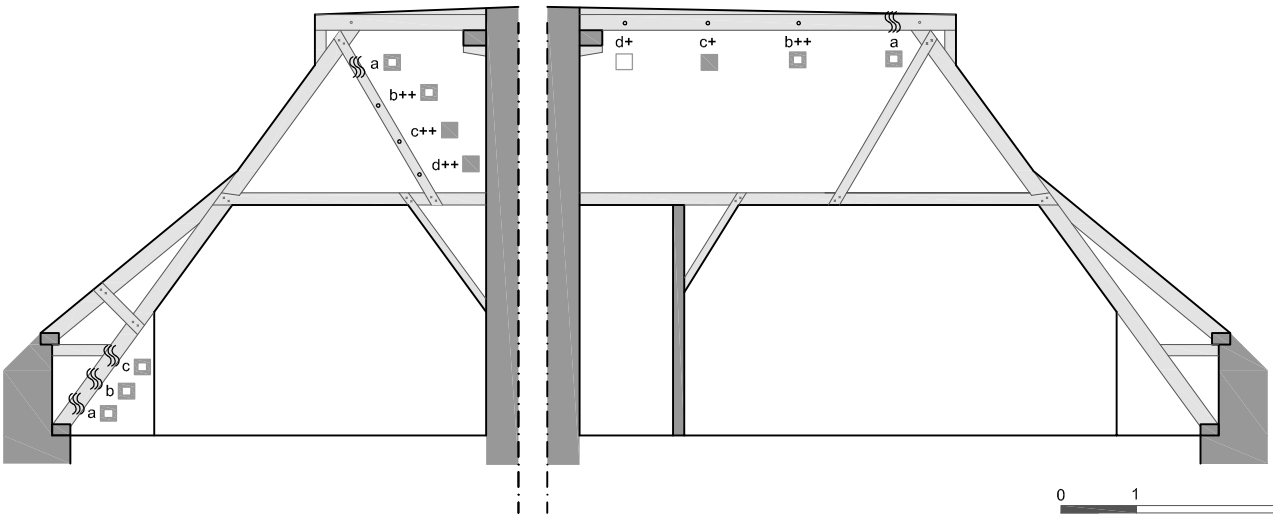
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20



Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & Int. decay
- extensive decay

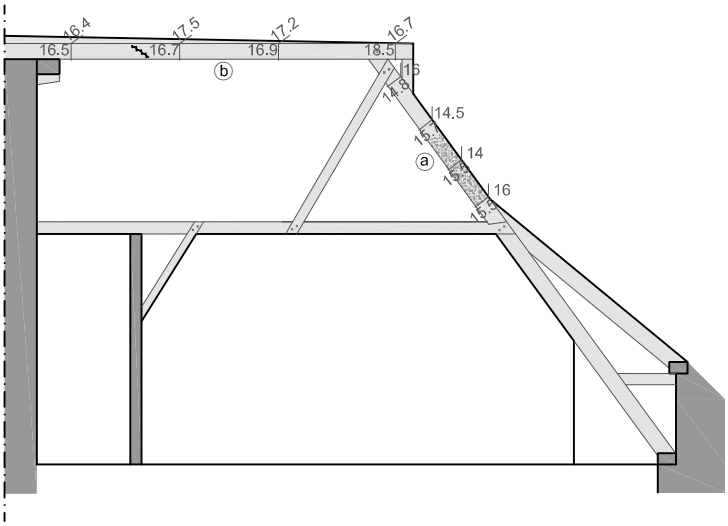


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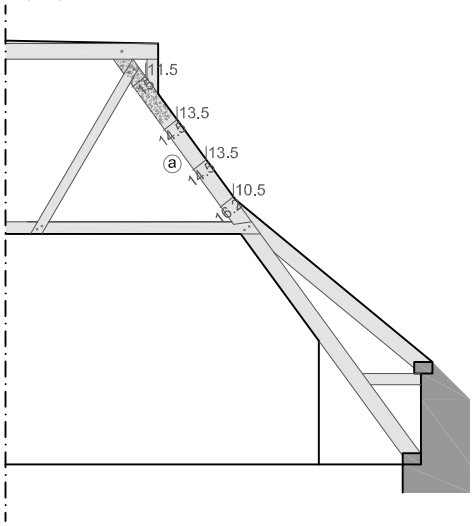
Sections 1:100 (looking East)

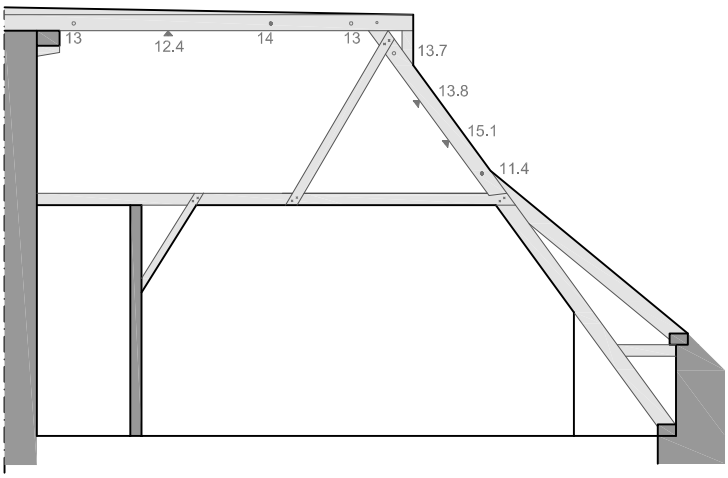
Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- (x) element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

Frame XXII



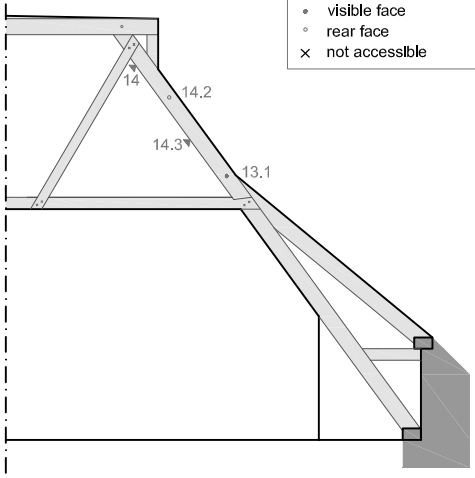
Frame XXXXIX





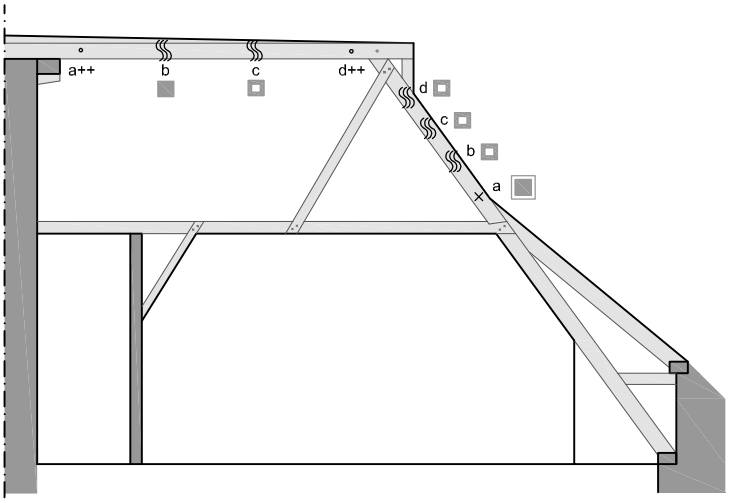
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

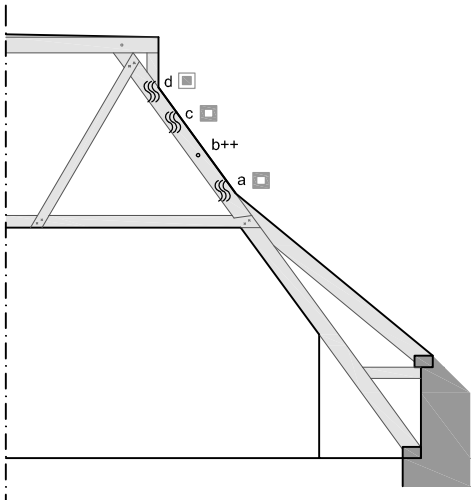
readings <18
readings >18
readings >20



Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & Int. decay
- extensive decay





0 1 5

Sections 1:100 (looking East)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- (x) element name
- wet surface
- efflorescence
- decayed peg
- Insect attack
- fungi attack

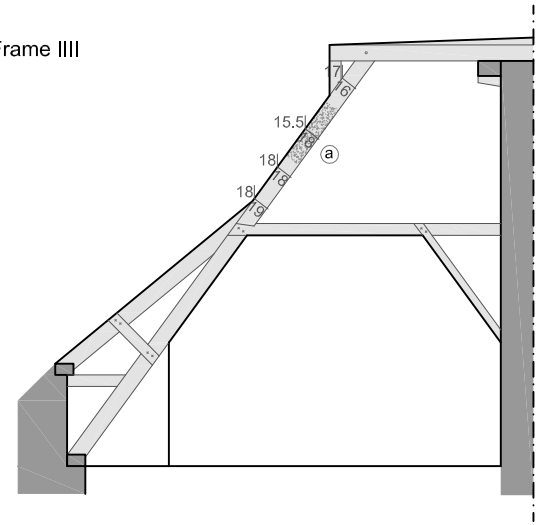
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

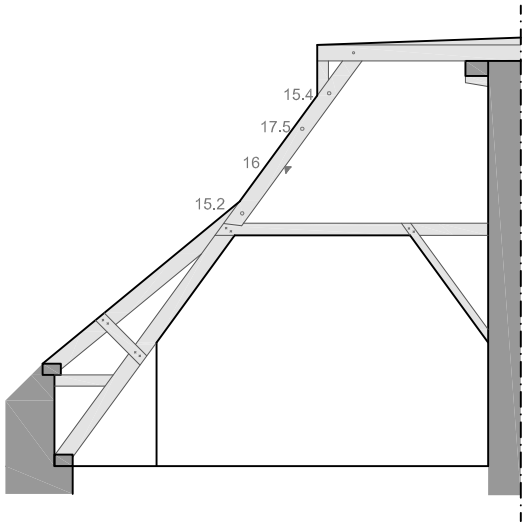
readings <18
readings >18
readings >20

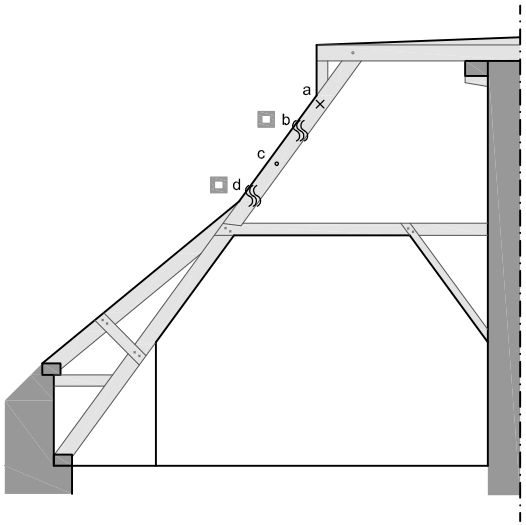
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- Internal decay
- ext. & int. decay
- extensive decay

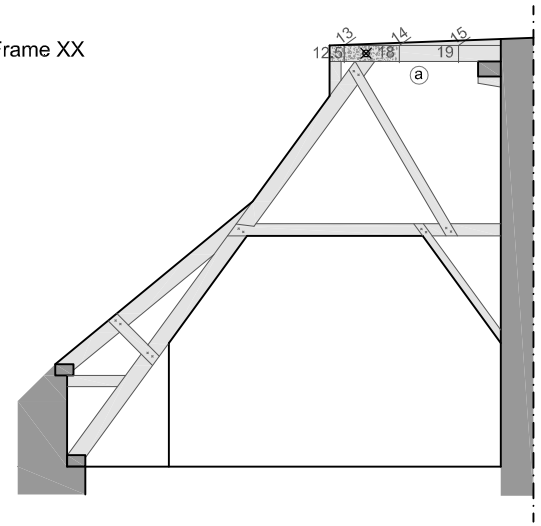
Frame IIII

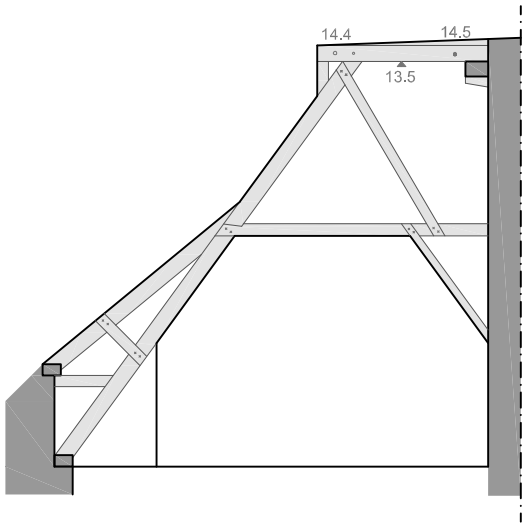


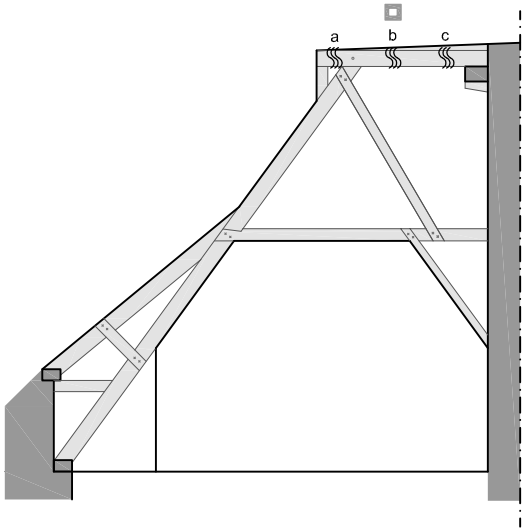




Frame XX







0 1 5

Sections 1:100 (looking East)

Visual inspection:
- highly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- (x) element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

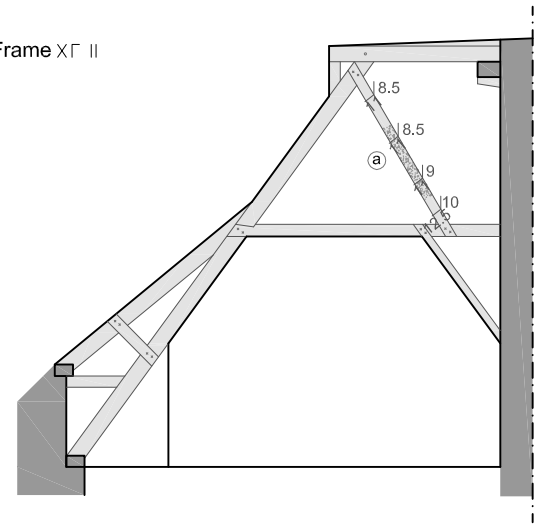
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

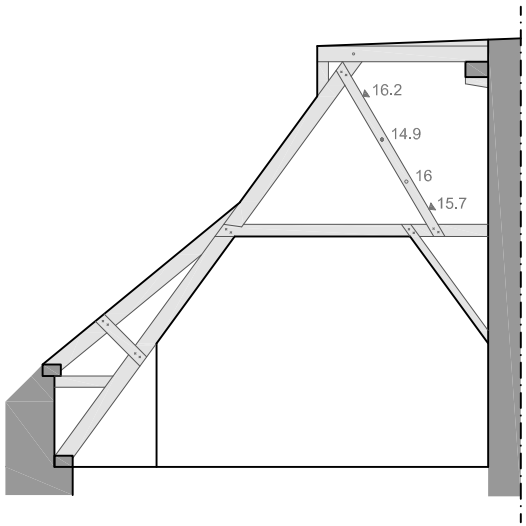
readings <18
readings >18
readings >20

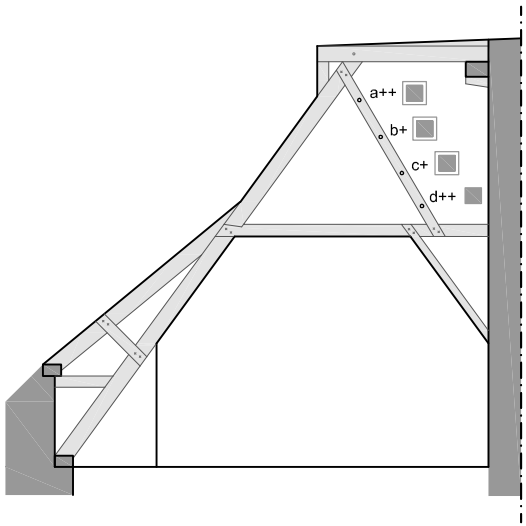
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- Internal decay
- ext. & int. decay
- extensive decay

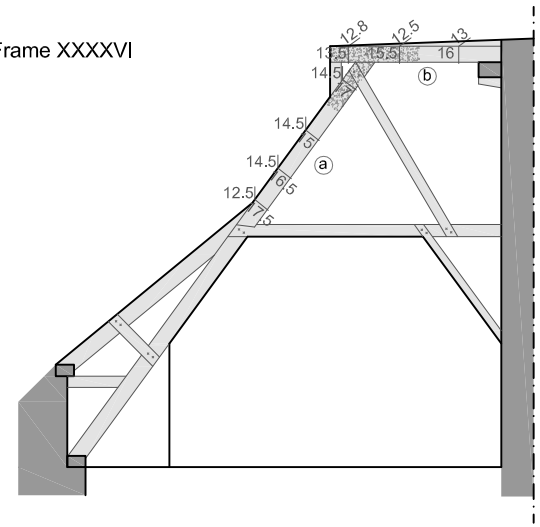
Frame XΓ II

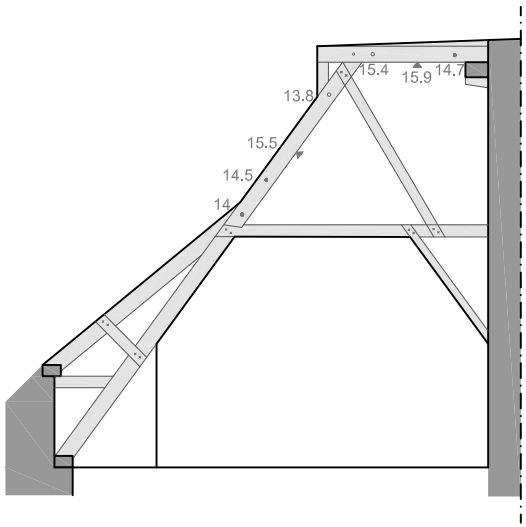


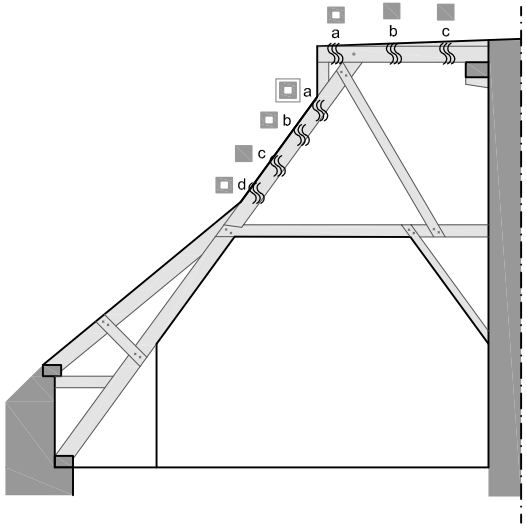




Frame XXXXVI







0 1 5

NEWHAILES HOUSE

Location: EAST LOTHIAN | INVERESK (EAST LOTHIAN)

X coordinate: 332781 Y coordinate: 672626

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PUBLIC

Rcahms ID: 53819

HS Listing: A

Original Use: Residential

Current Use: Museum

Freestanding: ☑ N. of floors above ground level: 4 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1686	1719	CENTRE BLOCK, CALLED WHITEHILL - JOE ROCK THINKS THERE WAS A RUIN TO THE NORTH WEST OF WHITEHILL (ABOUT 8 FEET FROM THE HOUSE), WHICH WAS LATER INCORPORATED IN THE HOUSE WHEN THE WEST WING WAS ADDED - ACCORDING TO JOE ROCK THE CONSTRUCTION OF WHITEHILL WA	BUILDINGS OF SCOTLAND COLLECTION & JOE ROCK WEBSITE

People involved:

Last Name	First Name	Role	Attributed
SMITH 1	JAMES 1	ARCHITECT, COMMISSIONERPATRON	☐
ANTONIUS	HENRY	WRIGHT	☐
MCLELLAN	JAMES	WRIGHT	☑
CAMPBELL	ROBERT	SMITH	☑
RAMSAY	ALEXANDER	GLAZIER	☑
HART	EDWARD NED	WRIGHT	☐
DAVIDSON	JAMES	MASON	☐
ISAAC	EDWARD	WRIGHT	☐
YOUNG	JOHN	MATERIAL SUPPLIER, WRIGHT	☐
CLARK	JOHN	PAINTER	☐
SUTHERLAND	JAMES	MERCHANT	☐
STEWART	PATRICK	MERCHANT	☐
CRIGHTON	JAMES	MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1717	1723	SOUTHEAST WING (LIBRARY) ADDED - INTERIORS: NEW STAIRCASE (NOW DEMOLISHED) AND HALL - HOUSE CALLED NEWHAILES FROM 1709	JOE ROCK WEBSITE & BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
GIBBS	JAMES	ARCHITECT	☑
ADAM	WILLIAM	ARCHITECT	☑
YOUNG	JOHN	WRIGHT	☐
BUCHANAN	JAMES	PLASTERER	☐
MACKENZIE	GEORGE	MERCHANT	☐
SIMPSON	GEORGE	GLAZIER	☐
SMITH 1	JAMES 1	ARCHITECT	☑
CRIGHTON	JAMES	MASON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1733	1751	NORTHWEST WING (STATE APARTMENT) ADDED, INCORPORATING THE RUIN - REVERSED THE ORIENTATION OF THE HOUSE WITH A DRIVEWAY FROM THE SOUTH ENTERING	JOE ROCK WEBSITE

THROUGH NEW STONE GATE PIERS - LIBRARY FINISHED - INTERIOR DECORATIONS

People involved:

Last Name	First Name	Role	Attributed
KENT	WILLIAM	ARCHITECT	☑
CRIGHTON	JAMES	MASON	☐
CLAYTON	THOMAS	PLASTERER	☐
NORIE	JAMES	PAINTER	☐
STRACHAN	WILLIAM	CARVER	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1907		NOT SPECIFIED	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2000		NOT SPECIFIED	JOE ROCK PERSONAL COMMENT

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	85
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	86
JOE ROCK WEBSITE		☐	HTTPS://SITES.GOOGLE.COM/SITE/NEWHAILESNEWRESEARCH/HOM	
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	

ARCHIVAL REFERENCES

Archive	Doc.Num.	Folios	Title
National Library of Scotland	MS 25818	42	Newhailes Estate Papers: account of John Young wright 1720
National Library of Scotland	MS 25818	50	Newhailes Estate Papers: account of John Young wright 1718
National Library of Scotland	MS 25818	49	Newhailes Estate Papers: account of Andrew Cuthbertson slater 1721
National Library of Scotland	MS 25837	157	Newhailes Estate Papers: account of timber 1723-4
National Library of Scotland	MS 25837	109	Newhailes Estate Papers: account of timber John Young wright 1722
National Library of Scotland	MS 25837	88	Newhailes Estate Papers: account of John Young wright 1721-2
National Library of Scotland	MS 25837	15	Newhailes Estate Papers: account of John Young wright 1722
National Library of Scotland	MS 25837	78	Newhailes Estate Papers: account of John Young wright 1722
National Library of Scotland	MS 25837	75	Newhailes Estate Papers: account of John Young wright 1722
National Library of Scotland	MS 25837	53	Newhailes Estate Papers: account of Jon Wilson 1722
National Library of Scotland	MS 25837	55	Newhailes Estate Papers: account of Jon Wilson 1722
National Library of Scotland	MS 25837	35	

Title	Newhailes Estate Papers: account of John Young wright 1722				
Archive	National Library of Scotland	Doc.Num.	MS 25837	Folios	81
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25833	Folios	222
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25834	Folios	9
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25783	Folios	77
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25834	Folios	36
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25834	Folios	139
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25834	Folios	113
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Archive	National Library of Scotland	Doc.Num.	MS 25834	Folios	117
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Archive	National Library of Scotland	Doc.Num.	MS 25834	Folios	110
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Archive	National Library of Scotland	Doc.Num.	MS 25835	Folios	82
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Archive	National Library of Scotland	Doc.Num.	MS 25783	Folios	144
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Archive	National Library of Scotland	Doc.Num.	MS 25836	Folios	87
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Archive	National Library of Scotland	Doc.Num.	MS 25836	Folios	224
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Archive	National Library of Scotland	Doc.Num.	MS 25791	Folios	95
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Archive	National Library of Scotland	Doc.Num.	MS 25836	Folios	208
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Archive	National Library of Scotland	Doc.Num.	MS 25836	Folios	236
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25836	Folios	237
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Archive	National Library of Scotland	Doc.Num.	MS 25837	Folios	43
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Archive	National Library of Scotland	Doc.Num.	MS 25837	Folios	101
Title	Transcription of Joe Rock				
Archive	National Library of Scotland	Doc.Num.	MS 25837	Folios	131
Title	Transcription of Joe Rock				

Archive	National Library of Scotland	Doc.Num.	MS 25837	Folios	140
Title	Transcription of Joe Rock				

Suggestions for further research

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive	National Library of Scotland	Doc. Num.	MS 25833	Folios	222
Title	Transcription of Joe Rock	Date: from	1709	to	
Contents	3 September: 'I Edward Isaate [Isaac], wright in Preston pans grants me to have received from John Adams, in name for his magisties Advocate the soume of thirtie three pund Scots monie which with ane hundred and seavon pund Scots formerlie received by me from my Ladie Hailles makes in hoall tuell [twelve] pund sterling to accompt for work wrought by me at the house of New Haills belong to my Lord Advocate written and subscribed be me at Edr. [Edinburgh] the 3 day of September 1709 be me Edward Isaate.				
Summary and comments	1709 Edward Isaac wright: account of non-specified work at Newhailes house.				
Archive	National Library of Scotland	Doc. Num.	MS 25834	Folios	36
Title	Transcription of Joe Rock	Date: from	1710	to	
Contents	31 May: Receipt from Edward Isaac, wright for £40 Scots and take his [-?-] therefore to account of lining my Lord's closet and other two rooms				
Summary and comments	1710 Edward Isaac wright: account of interiors work.				
Archive	National Library of Scotland	Doc. Num.	MS 25834	Folios	9
Title	Transcription of Joe Rock	Date: from	1710	to	
Contents	18 January: Payment to Patrick Sheills of Easter Dudingston, conform to My Ladys instructions £40 5s 8d [Scots]				
Summary and comments	1710 John Young wright: account of furnished stones.				
Archive	National Library of Scotland	Doc. Num.	MS 25783	Folios	77
Title	Transcription of Joe Rock	Date: from	1710	to	
Contents	17 April: Receipt by Edward [Ned] Hart, wright for £99 Scots to buy sixtie Sueds [Swedish?] deals and seven of them [67 in total?] and nails for lining the laigh [lower] dining room and Mr. James bed chamber at New Hailes [NLS MS 25834 f. 29] [Factor's accounts note payment to Edward Isaat, wright for buying timber and nails for lining the laigh dining room, £99 31 May: Payment to James Ramsay, wright for his gates £9 12s [Scots]				
Summary and comments	1710 Edward Hart wright and Edward Isaat wright: accounts of timber. No details of works. James Ramsay wright for gates.				
Archive	National Library of Scotland	Doc. Num.	MS 25834	Folios	113
Title	Transcription of Joe Rock	Date: from	1711	to	
Contents	8 May: Lady Hailes due to James Sutherland, To 40 deals £22 [Scots]				
Summary and comments	1711 James Sutherland merchant: account of deals.				
Archive	National Library of Scotland	Doc. Num.	MS 25834	Folios	117
Title	Transcription of Joe Rock	Date: from	1711	to	
Contents	10 May: Leith, £32 Scots for 40 deals to Lady Dalrymple, James Sutherland				
Summary and comments	1711 James Sutherland merchant: account of deals.				
Archive	National Library of Scotland	Doc. Num.	MS 25834	Folios	110
Title	Transcription of Joe Rock	Date: from	1711	to	
Contents	18 September: Receipt by Edward Isaat, wright for £20 Scots, in part payment for wright work at Newhailes				
Summary and comments	1711 Edward Isaac wright: account of non specified work.				
Archive	National Library of Scotland	Doc. Num.	MS 25834	Folios	139
Title	Transcription of Joe Rock	Date: from	1711	to	
Contents	20 [January?]: Receipt by Edward Isaat, wright in Dalkeith for £12 Scots in part payment of plaster work done by him.				
Summary and comments	1711 Edward Isaac wright: plaster work.				
Archive	National Library of Scotland	Doc. Num.	MS 25835	Folios	82
Title	Transcription of Joe Rock	Date: from	1715	to	
Contents	27 July: Pay to John Young wright, £41 12s Scots for 26 ells [97.5 ft.] lining presently done to the upper dining room by My Ladies				

order

Summary and comments: 1715 John Young wright: accounts of interior works.

Archive: National Library of Scotland | Doc. Num.: MS 25783 | Folios: 144

Title: Transcription of Joe Rock | Date: from 1717 to

Contents: 14 November: Payment to John Young, wright for work wrought at Newhailes per acct. My Ladys order £3 6s 8d.

Summary and comments: 1717 John Young wright: account of unspecified work.

Archive: National Library of Scotland | Doc. Num.: MS 25818 | Folios: 50

Title: Newhailes Estate Papers: account of John Young wright 1718 | Date: from 1718 to

Contents: John Young, 1718, wright work in office houses and parks of Newhailes

Summary and comments: 1718 wright John Young: office houses and parks

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 206

Title: Transcription of Joe Rock | Date: from 1719 to

Contents: 30 November: Account from Joseph Forester, plumber for 515 stone lead £8 4s 5½d stg. Discharged 3 June 1721

Summary and comments: 1719 Joseph Forester plumber: account of lead.

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 87

Title: Transcription of Joe Rock | Date: from 1719 to

Contents: 8 August: 'Articles of agreement between Patrick Stewart, merchant in Edinburgh and William Rig writer there; The said Patrick Stewart obliges himself to deliver betwixt [now] and Michaelmas next the number of twenty thousand bleu sclaits or scailzie of the dimensions following. Viz. The shortest to be ten inches long and six inches broad at the lower end with four easing sclaits to each hundred, the foresaid easings not to be under eight inches broad & fifteen inches long and to be delivered free of all charges at Fisherrow port to the Leige or James Geddeses for the which charges the said William Big obliges himself by [?] &c To pay the said Patrick Stewart or order at the said term of Michaelmas the sum of forty pounds sterling money being at the rate of forty shill: sterl for each thousand...' Noted verso: 'Edinburgh 3 September 1719, Receipt from Patrick Stewart for £25 stg. from W Rigg'

Summary and comments: 1719 Patrick Stewart merchant: account of slates. Joe Rock thinks it's a big amount that could cover all the house, including the wings.

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 43

Title: Transcription of Joe Rock | Date: from 1719 to

Contents: 1 April: Receipt from John Young for 4 guineas for wright work of the new building at Newhailes

Summary and comments: 1719 John Young wright: accounts of non-specified works.

Archive: National Library of Scotland | Doc. Num.: MS 25791 | Folios: 95

Title: Transcription of Joe Rock | Date: from 1720 to 1721

Contents:
Nsd. Series of unitemised payments made by James Dalrymple, 1720-21:
Forrester, plumber, £8 14s 5d.
James Craig, timber, £28.
George Simson, glazier for the library windows, £5 2s 2d.
John Young, wright in full of account, £27 17s.
William Craig, smith, Potterrow, £5.
William Miller in part for garden seeds, 1719, 1720, 1721, £10.
James Henry, coppersmith, £1 1s 6d.
John Steell acct. £7 2s 7d. [brewer]
Andrew Cuthbertson for the office houses at Newhailes, £4 15s 10d

Summary and comments: 1720-1 various accounts including timber and non-specified work by John Young wright.

Archive: National Library of Scotland | Doc. Num.: MS 25818 | Folios: 42

Title: Newhailes Estate Papers: account of John Young wright 1720 | Date: from 1720 to

Contents:
Mr Dalrymple of Hailes Esquire's Accompt of wright work wrought be John Young at the New Building of New Hailes Aprile 1720
barrows, tresses for masons, doors, *bearers to the stair*, *boxes to the windows*, closets, scaffolding for masons/slaters/, *safe lintels to the windows*, lodge for masons,
[...] *Item for sawing the trees and making the wallpletts £10*
[...] *Item making the roof to the Library £296 12s.*
[...] *Item for sawing 200 dailles to lath the roof of the Library and the four closets £20*
Item for putting up the inside of the roof of the library with the roofs of the four closets £40
Item for cutting the roof of the main house to gett out the stone conness? 12s.
Item for necessarie charges in going to buy timber £12
tot £286 10s.

Summary and comments: 1720 wright John Young: materials and works related to the roof above the library

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 224

Title: Transcription of Joe Rock | Date: from 1720 to

Contents: 30 November: Account from Joseph Forester, plumber for 515 stone lead £8 4s 5½d stg. Discharged 3 June 1721

Summary and comments: 1720 George Mackenzie merchant: account of 144 trees.

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 236

Title: Transcription of Joe Rock | Date: from 1721 to

Contents: 22 July: Receipt from Thomas Curie for 16 double trees at £1 8s per piece.
40 deals at 15s per piece.
1 spar at 8s.
Total £52 16s, discharged 8 November 1721.
Countersigned by John Young, wright.

Summary and comments: 1721 Thomas Curie merchant: account of 16 double trees, deals and a spar.

Archive: National Library of Scotland | Doc. Num.: MS 25837 | Folios: 43

Title: Transcription of Joe Rock | Date: from 1721 to

Contents: 5 October: Receipt from John Young, wright for £15.

Summary and comments: 1721 John Young wright: non-specified.

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 208

Title: Transcription of Joe Rock | Date: from 1721 to

Contents: 14 April: Receipt from John Young, wright, part payment for wright work at the library... Discharged by Henry Fletcher witnessed by James Geddes and William Rig writer in Edinburgh 'at the park end of New Hailes'.

Summary and comments: 1721 John Young wright: account of work at the library.

Archive: National Library of Scotland | Doc. Num.: MS 25818 | Folios: 49

Title: Newhailes Estate Papers: account of Andrew Cuthbertson slater 1721 | Date: from 1721 to

Contents: Andrew Cuthbertson slater, 1721, for slating the main roof of Newhailes

Summary and comments: 1721 main block of Newhailes slated

Archive: National Library of Scotland | Doc. Num.: MS 25837 | Folios: 88

Title: Newhailes Estate Papers: account of John Young wright 1721-2 | Date: from 1721 to 1722

Contents: *Sr James Dalrymple of haills Account of wright work ??? John Young since the first Jullay 1721 to the ffirst of May 1722 of seavirill pisis of work about the Newhous and officesis housis*
[...] *Item for putting up the roofs of the offishousis £2*
[...] *Item for mending the roof of the Mainhows £1 10s.*
tot £18

Summary and comments: 1721-2 wright John Young: works on roofs of office houses and main house, but very limited expenses thus limited works.

Archive: National Library of Scotland | Doc. Num.: MS 25836 | Folios: 237

Title: Transcription of Joe Rock | Date: from 1721 to

Contents: 25 July: Receipt from Mr. James Craig for 140 double trees, £28 stg. The trees are for Sir David Dalrymple's new building. Discharged by Henry Fletcher of Saltoun 5 August.

Summary and comments: 1721 James Craig merchant: account of 140 double trees.

Archive: National Library of Scotland | Doc. Num.: MS 25837 | Folios: 101

Title: Transcription of Joe Rock | Date: from 1722 to

Contents: 5 October: Receipt from John Young, wright for £15.

Summary and comments: 1722 wright John Young: non-specified.

Archive: National Library of Scotland | Doc. Num.: MS 25837 | Folios: 78

Title: Newhailes Estate Papers: account of John Young wright 1722 | Date: from 1722 to

Contents: Mrs Butt, 1722,
80 choice clean deals, wainscot, planks
tot £11
John Young bought them from her

Summary and comments: 1722 wright John Young: deals and planks bought from Mrs Butt. No details of works.

Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	109
Title	Newhailes Estate Papers: account of timber John Young wright 1722	Date: from	1722	to	
Contents	*1722 The Honnrd Sir James Dalrymple of Hails ??? To Jon Wilson for timber funrnished to the new building att Newhails* *June 5th To 300 Choice long dealls att £26* *to workmen to help of the timber transportance? to Leith the 5 of June 1722* *I John Young wright in ??? Grant me to have recaived the above number of dealls for the use of Sir James Dalrymple of haills as writis my hand ..... John Young*				
Summary and comments	1722 wright John Young: account of timber deals purchase and transport. No details of works.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	15
Title	Newhailes Estate Papers: account of John Young wright 1722	Date: from	1722	to	
Contents	John Young 31 August 1722 22 planks 13 feet long 4 1/4 inches thick 3 planks 9 feet long 4 1/2 inches thick tot £4				
Summary and comments	1722 wright John Young: planks of different sizes. No details of works.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	75
Title	Newhailes Estate Papers: account of John Young wright 1722	Date: from	1722	to	
Contents	John Young 31 August 1722 22 planks 13 feet long 4 1/4 inches thick 3 planks 9 feet long 4 1/2 inches thick tot £4				
Summary and comments	1722 wright John Young: planks of different sizes. No details of works.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	53
Title	Newhailes Estate Papers: account of Jon Wilson 1722	Date: from	1722	to	
Contents	Jon Wilson, 3rd August 1722 100 choice clean deals 12 feet long 200 long deals tot £26				
Summary and comments	1722 account of deals. No details of works.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	55
Title	Newhailes Estate Papers: account of Jon Wilson 1722	Date: from	1722	to	
Contents	John Young for Jon Wilson, 12th July 1722 60 clean choiced fine deals				
Summary and comments	1722 account of deals. No details of works.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	35
Title	Newhailes Estate Papers: account of John Young wright 1722	Date: from	1722	to	
Contents	John Young for Jon Wilson, 12th July 1722 60 clean choiced fine deals				
Summary and comments	1722 John Young wright: account of deals and tar. No details of works.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	131
Title	Transcription of Joe Rock	Date: from	1722	to	
Contents	13 July: Account from John Wilson, merchant in Edinburgh. 60 choice clean flooring deals £5. Noted Leith, 12 July 1722, received from John Wilson, merchant in Edinburgh, signed John Young. Discharged 18 January 1723				
Summary and comments	1722 John Wilson merchant: account of timber deals.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	81
Title	Transcription of Joe Rock	Date: from	1722	to	
Contents	2 February: Received from capt. Matthew Campbell: 86 fine flooring deals 17ft long £8 12s. sent to the library at Newhailes. To William Mitchell received.				
Summary and comments	1722 account of timber deals for the library.				
Archive	National Library of Scotland	Doc. Num.	MS 25837	Folios	157
Title	Newhailes Estate Papers: account of timber 1723-4	Date: from	1723	to	1724
Contents	[one side] *Accompt of timber ??? ???*				

[other side] *1723 Mr James Winram? Bot of Sam Stanton*
Octr 4th To 16 cuphars a 15d. 12s. 6d.
To 6 half deals a 6d. 3s.
To 1 ps Oake 6d. 16s.
For the Wester butess? Wilson
6 Nov 1724 Contents ??? by Sam Stanton

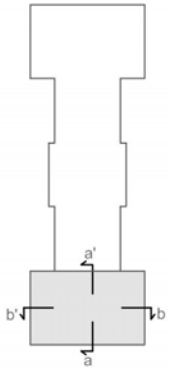
Summary and comments: 1723-4 account of timber (few deals and others). No details of works.

Archive: National Library of Scotland | Doc. Num.: MS 25837 | Folios: 140

Title: Transcription of Joe Rock | Date: from 1723 to

Contents: 1 February: Receipt by John Young, wright for £10

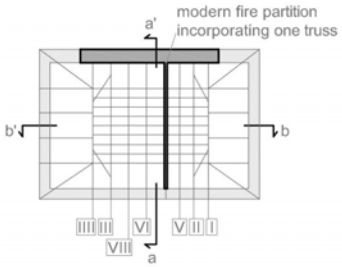
Summary and comments: 1723 John Young wright: non specified.



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

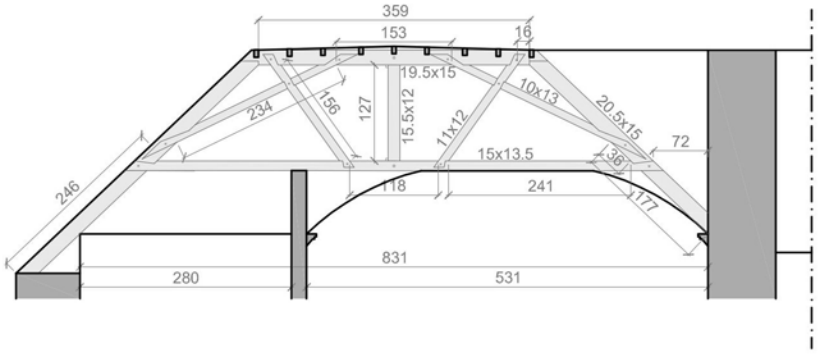
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

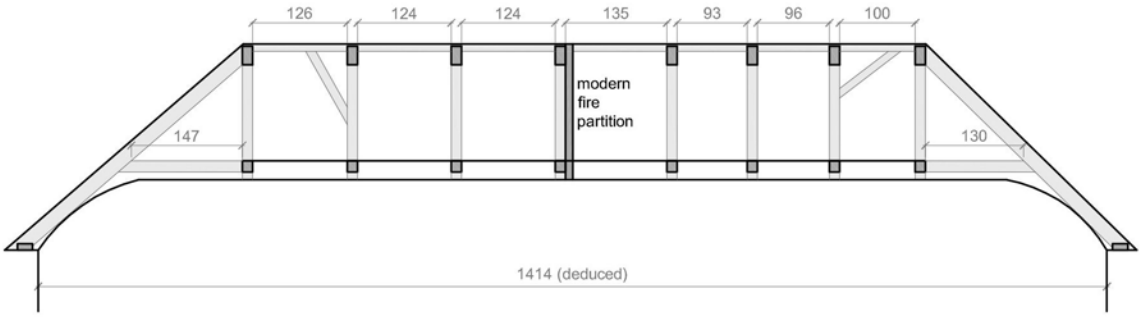
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

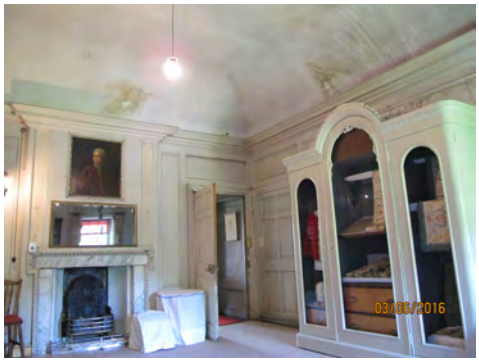
Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



one of the attic spaces underneath I:\Arch\A

INITIAL SURVEY | **Building name** NEWHAILES HOUSE | **Roof location** N wing

Survey date(s) 18/09/2014 | See drawing: NH-N-1

Roof Geometry: Flat, Hipped

Roof Max Span [m]: 8.3 | Roof Height [m]: 3

Roof Pitch/es [°]: 43 | Roof Length [m]: 13.2

Type of Primary Structure: 2D framing

Truss ☑ OTHER

Frame ☐ Other

Average Distance in between Primary Structure [m]: 1.3

Type of Secondary Structure: common rafters, purlins, sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1733 To 1751 Identified by: Estimated

Roof General Description:

Only the N wing of the house could be surveyed. It's a flat hipped roof with 8 trusses. Each truss has an upper beam and a collar, a central post and 2 diagonal struts, one connecting the rafter to the upper beam and the other connecting the upper beam to the collar. The collar is raised to leave space for the partially vaulted ceiling underneath. The upper beam has a varying scantling, bigger in the middle, so to provide a slope for the rain water. The trusses support a series of small purlins and common rafters.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 20.5 B: 15 Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: dovetail, lapped, mortice and tenon, notch

Fasteners Types: Metal nail, Timber dowel

Joints description:

All lapped dovetail chamfered with metal nails, except for the post which has mortice and tenon with timber pegs and wedges, and for the joint between the rafters and the upper tie-beam which is a notched mortice and tenon. Cross notched lapped joint between 2 struts.

Wood Species: all pinus sylvestris except for the post which is picea abies and the dowels which are quercus sp.

Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description:

Numbered from I to VIII (even though number VII is not visible), but not in sequence.

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology



Roof structure link I:\Arch\A



Roof structure link I:\Arch\A



Timber elements' dressing link I:\Arch\A



Joint: post and lower tiebeam link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation

Accessibility limitations

Past interventions: Recent work include a fire partition, addition of floor boards, and replacement of most of the sarking and of some purlins. The sarking has been replaced with floor boards which don't allow for ventilation.



Past interentions | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐

Diffuse insect exit holes ☑

Most timbers have diffuse insect exit holes on the axed faces only, which means that the insect attack is confined to the sapwood.

	Damage Type:	Damage Status:	Damage Role:	link
Roof Damage				
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes: The roof space was probably in use in the past since there is plastering inside. Most of the joints of the struts connecting the collars to the upper beams are partly open (1 cm max) which seems to indicate that they are working in tension. The posts and upper beams are slightly twisted, probably because all of the joints are on one side.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

DETAILED SURVEY **Building name** NEWHAILES HOUSE **Roof location** N wing

Survey date(s) 03/06/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings NH-N-1, NH-N-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
North-west rafters	430	rectangular	bending, compression		the visible face is hand axed
South-east rafters	312	rectangular	bending, compression	pinus sylvestris	the visible face is hand axed
Upper beams	408	rectangular	bending	pinus sylvestris	3 faces hand axed and 1 face hand sawn
Lower beams	714	rectangular	bending, tension		the visible face is hand axed
Struts: collar & upper beam	184	rectangular	tension		2 hand axed faces and 2 hand sawn faces
Struts: rafter & upper beam	317	rectangular	compression	pinus sylvestris	2 hand axed faces and 2 hand sawn faces
Posts	127	rectangular	compression	picea abies	2 faces hand axed and 2 faces hand sawn
Sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

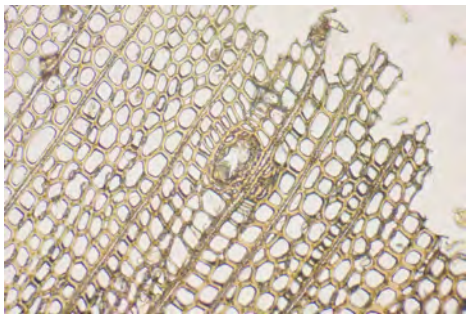
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings NH-N-1, NH-N-2

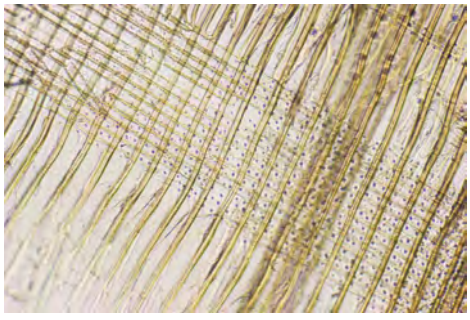
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & upper beam	Corner mortice & tenon	compression, shear	none	
rafter & collar	Encounter dovetail	tension	nails	
strut & strut	Crossing halved notched	tension	nails	
strut & other	Encounter dovetail	compression, tension	nails	
post & other	Encounter mortice & tenon	compression	wooden dowels, wooden keys	quercus sp.

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

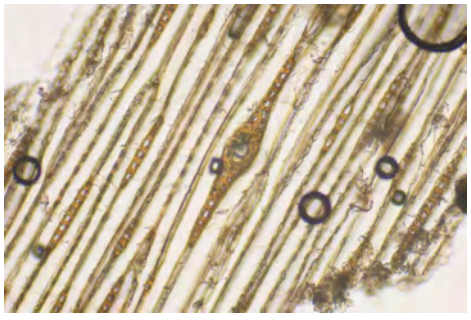
Microscopic identification of the timber species See drawing NH-N-2



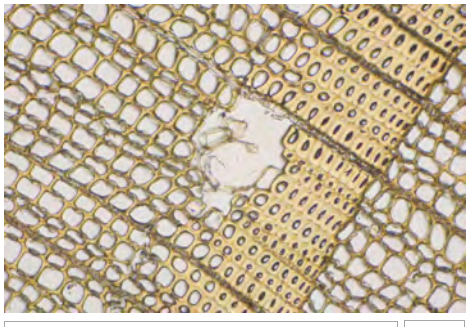
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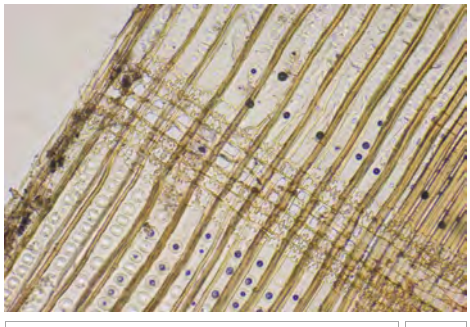
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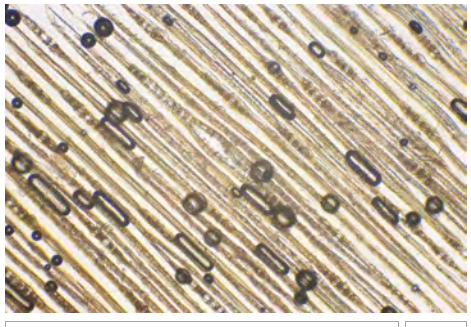
Post: tang. Section x100 I:\Arc



Rafter: transv. Section x100 I:\Arc



Rafter: radial section x100 I:\Arc



Rafter: tang. Section x50 I:\Arc

Air Temperature and Relative Humidity measurements See drawing NH-N-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
attic space	NW corner	03/06/2016	10:30 am	17.7	57
attic space	SE corner	03/06/2016	10 am	18	55.8
attic space	NE corner	03/06/2016	10:15 am	17.6	57
roof space	Close to frame I	03/06/2016	11:15 am	19	54.3
roof space	Close to frame III	03/06/2016	11 am	18.7	55.1

Frame/Truss name II See drawing NH-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other

Element name A strut upper beam & collar

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.3x12.5 | min. size (hxb) [cm] 10.2x12.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%] 9 tangential

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other insect exit holes on axed faces

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a

Moisture Content [%] 14.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.3 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B strut upper beam & rafter

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 9.1x13.9 | min. size (hxb) [cm] 9.8x13.3 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%] 16 tangential

Knots [min d/section h] 1.5/14 single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other insect exit holes on axed faces

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification visual inspection

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	14.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	13.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	15.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C northwest rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues only one face (and the two side ones partially) visible because of plaster

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification visual inspection

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D upper beam

Dating original construction Signs of reuse redundant lap joint on corner top - probably removed element

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 20.2x15.4 min. size (hxb) [cm] 19.5x15 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 3.5/15.2 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



redundant lap joint on top corner I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 15.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 13.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name E post

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 16x11.7 min. size (hxb) [cm] 16x11.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 3.5/16 group Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Estimated level of damage Emergency interv. needed ☐

Past interv. ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name F strut upper beam & collar

Dating original construction Signs of reuse

Timber treated ☐

Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.2x11.7 min. size (hxb) [cm] 10x11.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential

Knots [min d/section h] 1.5/11.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Estimated level of damage Emergency interv. needed ☐

Past interv. ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name G strut upper beam & rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.1x14 min. size (hxb) [cm] 9.7x13.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 1.3/8.3 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a

Moisture Content [%] 13.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 13.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name I south east rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues: only one face (and the two side ones partially) visible because of plaster

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☐ Jointed element ☐

Strength affecting defects

Pith location Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a

Moisture Content [%]: 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 14.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name H lower beam

Dating: original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues: only one face visible due to inspection floor boards

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☐ Jointed element ☐

Strength affecting defects

Pith location Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a

Moisture Content [%]: 13.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Measurement Point d

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Measurement Point e

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Frame/Truss name III See drawing NH-N-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other

Element name A strut upper beam & collar

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.2x11.9 | min. size (hxb) [cm] 11x11.9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%] 12 tangential

Knots [min d/section h] 2.3/11 single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other: insect exit holes on axed faces

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a

Moisture Content [%] 13.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name B strut upper beam & rafter

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 4 | tangential

Knots [min d/section h]: 1.5/10 | single | Knotty element ☑ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I



knots on the strut | I:\Arc

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other: insect exit holes on axed faces

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a			
Moisture Content [%]	15.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	14.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	14.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C north west rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: not visible because of plaster

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119:



plaster partly hiding the section | I:\Arc

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D upper beam

Dating: original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 17.7x14.4 min. size (hxb) [cm] 15.8x14.3 Single piece ☑ Jointed element ☐

Strength affecting defects
Pith location: side
Slope of grain [%]: 5 tangential
Knots [min d/section h]: 2.5/14 single
Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects: 4cm deep check on one side all along the element
Estimated Strength Class according to UNI 11119: I


old humidity stains I:\Arc

Material degradation
Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other: insect exit holes on axed faces. Old humidity stains.

Mechanical Damage
Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 15.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 15 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d
Moisture Content [%] 16 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name E post

Dating: original construction
Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.9x11.7 | min. size (hxb) [cm] 15.4x11.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%] 1 | tangential

Knots [min d/section h] 1.7/11.5 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



the dressing | I:\Arc

Material degradation

Insect attack ☐ | Type | Status

Way of identification

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other: insect exit holes on axed faces

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15.8 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name F strut upper beam & collar

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.4x10.9 | min. size (hxb) [cm] 10x10.8 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%] 9 | tangential

Knots [min d/section h] 5.5/9.5 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 lower than III

Material degradation

Insect attack ☐ | Type | Status

Way of identification

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other: insect exit holes on axed faces

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Mater.Degr. and Damage Extent: No decay/damage
Way of identification: visual inspection

Measurement Point a
Moisture Content [%]: 13.9 — Visible Material Degradation ☐ — Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%]: 14.1 — Visible Material Degradation ☐ — Not Accessible for: hygrometer ☐

Element name G strut upper beam & rafter

Dating: original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]: 9.7x13.4 min. size (hxb) [cm]: 9.5x13.4 Single piece ☑ Jointed element ☐

Strength affecting defects
Pith location: side Slope of grain [%]: 2 tangential
Knots [min d/section h]
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119: I

Material degradation
Insect attack ☐ Type Status Way of identification
Fungi attack ☐ Type Status Way of identification
Corrosion ☐ Wet surface ☐ Other: insect exit holes on axed faces

Mechanical Damage
Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Mater.Degr. and Damage Extent: No decay/damage
Way of identification: visual inspection

Measurement Point a
Moisture Content [%]: 13.9 — Visible Material Degradation ☐ — Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%]: 13.8 — Visible Material Degradation ☐ — Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%]: 14.2 — Visible Material Degradation ☐ — Not Accessible for: hygrometer ☐

Element name H lower beam

Dating: original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues: only one face visible due to inspection floor boards
Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location | Slope of grain [%] | Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a			
Moisture Content [%]	15.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	14.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]		Visible Material Degradation ☐	Not Accessible for: hygrometer ☑
Measurement Point d			
Moisture Content [%]		Visible Material Degradation ☐	Not Accessible for: hygrometer ☑
Measurement Point e			
Moisture Content [%]		Visible Material Degradation ☐	Not Accessible for: hygrometer ☑

Element name I south east rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Past interventions

Accessibilityissues: only one face (and the two side ones partially) visible because of plaster

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location | Slope of grain [%] | Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage

Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

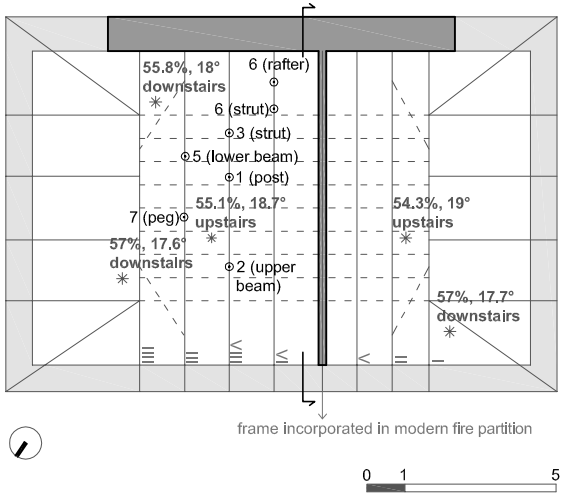
External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%]	Visible Material Degradation ☐	Not Accessible for: hygrometer ☑
Measurement Point b		
Moisture Content [%]	Visible Material Degradation ☐	Not Accessible for: hygrometer ☑

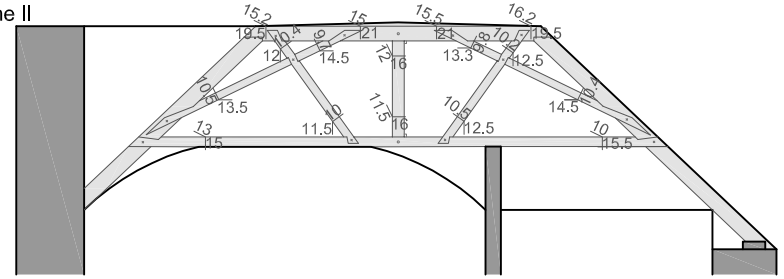
Plan 1:200

- ✳ air humidity and temperature
- ⊙ timber samples for species identification

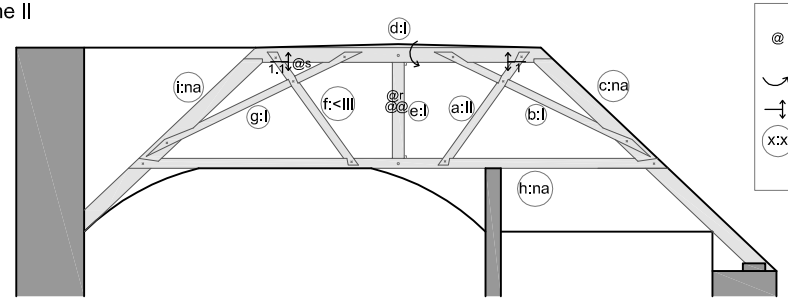


Sections 1: 100 (looking South)

Frame II



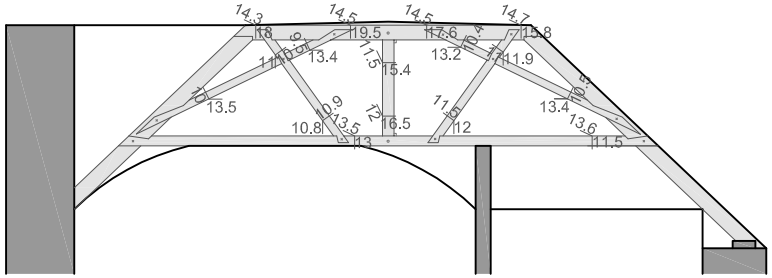
Frame II



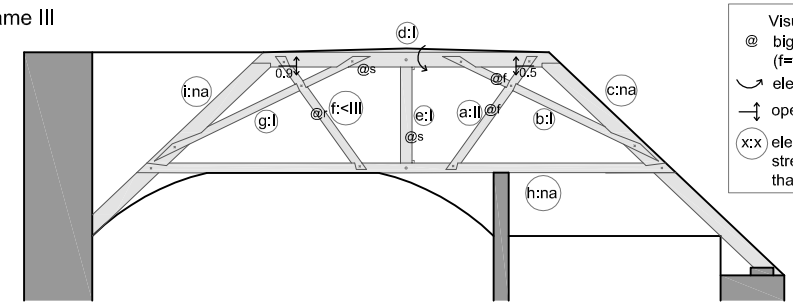
Visual inspection:
- @ big knots (f=front, r=rear, s=sides)
- element rotation
- open joint (measure in cm)
- x:x element name : estimated strength class (na=less than 2 faces visible)

Sections 1: 100 (looking South)

Frame III

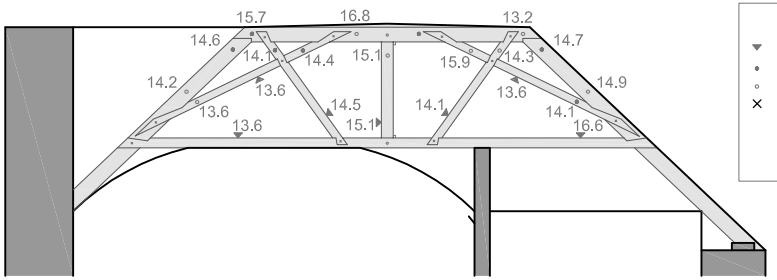


Frame III



Visual inspection:
- @ big knots (f=front, r=rear, s=sides)
- element rotation
- open joint (measure in cm)
- x:x element name : estimated strength class (na=less than 2 faces visible)

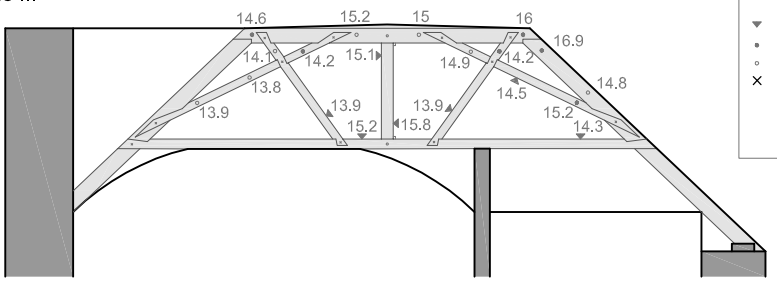
Frame II



Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

Frame III



Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

0 1 5

PINKIE HOUSE

Location: EAST LOTHIAN | INVERESK (EAST LOTHIAN)
X coordinate: 334880 Y coordinate: 672651
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Rcahms ID: 53873
HS Listing: A

Original Use: Residential
Current Use: School

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1575	1600	L SHAPED HOUSE INCORPORATING EARLIER FORTALICE	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1613		RETAINED THE TOWER ADDING A PAIR OF SQUARE PEPPERPOTS AT THE NORTH END - RAISED THE PROJECTING JAMB 2 STOREYS HIGHER - BUILT A NEW LONG WING TO SOUTH	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
SETON	SIR ALEXANDER 1ST	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1675	1705	WEST WING	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1768	1778	REPAIR WORKS TO ROOFS	NLS MS14716

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1795	1805	WEST SIDE	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1955		STRENGTHENING OF THE LONG HALL ROOF	HES REPORT

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
BATH M.	2013	☐	PHILOSTRATUS COMES TO SCOTLAND: A NEW SOURCE FOR THE PICT PINKIE	
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME II. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	392-398
DUNBAR J. G.	1978	☐	THE ARCHITECTURE OF SCOTLAND	70
HANKE T.	2004	☐	THE STABLE OF HALKERSTON LODGE AND MORAY HOUSE - ROOF ARCHITECTURE OF THE 1630S AROUND EDINBURGH	
HANKE T.	2006	☑	THE DEVELOPMENT OF ROOF CARPENTRY IN SOUTHEAST SCOTLAND	
MACDONALD A.	2016	☑	PRELIMINARY CONCLUSIONS ON STRESS CALCULATIONS FOR ROOF T PINKIE HOUSE, MUSSELBURGH (JUNE 2016)	

Author	Year	Unpubl.	Title	Pages
MCKEANE C.	2001	☐	THE SCOTTISH CHATEAU. THE COUNTRY HOUSE OF RENAISSANCE SC	183-188
MCWILLIAM C.	1928	☐	THE BUILDINGS OF SCOTLAND COLLECTION: LOTHIAN, EXCEPT EDINE	
SUMMERSON S. J. N.	1963	☐	THE CLASSICAL LANGUAGE OF ARCHITECTURE	507

ARCHIVAL REFERENCES

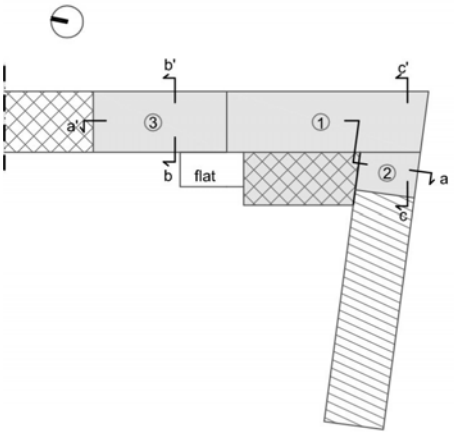
Archive	National Library of Scotland	Doc.Num.	MS 14716	Folios	
Title	Accounts of Hay family				
Archive	HES	Doc.Num.	uncatalogued	Folios	
Title	Report by HES technical officer WR Adams				
Archive	RCAHMS	Doc.Num.	LOR/M/17/5	Folios	
Title	Plans and elevations showing additions and alterations. Details showing new floor to painted gallery. Details showing roof over painted ceiling and catwalk.				
Archive	HES	Doc.Num.	uncatalgoued	Folios	
Title	Letter from Rentokil (Ratsouris Scotland Ltd) detailing proposed insecticidal treatment of main roofspace and provision of a thermal quilt (July 1973)				

Suggestions for further research	Hay papers in NLS

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

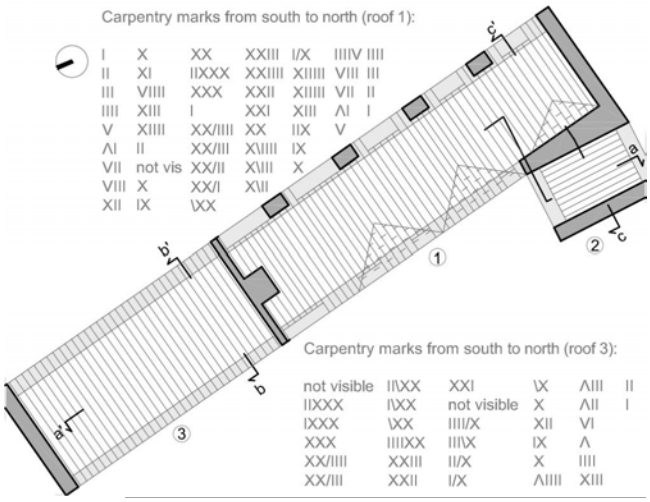
Archive	National Library of Scotland	Doc. Num.	MS 14716	Folios	
Title	Accounts of Hay family	Date: from	1768	to	1778
Contents	1768-78 repairs to the roof for a tot £16 86d. 48s.				
Summary and comments	1768-78 works to roof for £16. No details of works but they could be related to the addition of the struts to counteract the deflection of the lower collars and the cracking of the ceiling underneath.				
Archive	RCAHMS	Doc. Num.	LOR/M/17/5	Folios	
Title	Plans and elevations showing additions and alterations. Details showing new floor to painted gallery. Details showing roof over painted ceiling and catwalk.	Date: from	1954	to	
Contents					
Summary and comments	1955 roof strengthened with additional collars.				
Archive	HES	Doc. Num.	uncatalogued	Folios	
Title	Report by HES technical officer WR Adams	Date: from	1954	to	
Contents	[...] *A scheme to generally strengthen the main roof was submitted to the Private Architect in charge of the general alterations to the House for his consideration and comment. Briefly, this amounted to the introduction of new ties at a higher level than the existing ties and twice bolted to the main rafters at each end. On this new framework a catwalk was to be built to carry the load of foot traffic and assist in periodic inspection of the roof space. This meant that the original ceiling beams would only serve to carry the painted boards and that the main thrust of the roof would be transmitted to the wallheads and vibration on the painted boards reduced to minimum. This scheme was approved and carried out at a later date.* [....				
Summary and comments	1955 roof strengthened with additional collars.				
Archive	HES	Doc. Num.	uncatalgoued	Folios	
Title	Letter from Rentokil (Ratsouris Scotland Ltd) detailing proposed insecticidal treatment of main roofspace and provision of a thermal quilt (July 1973)	Date: from	1973	to	
Contents					
Summary and comments	Rentokil proposes insect treatment and insulation of roof in 1973				



Legend (plans):

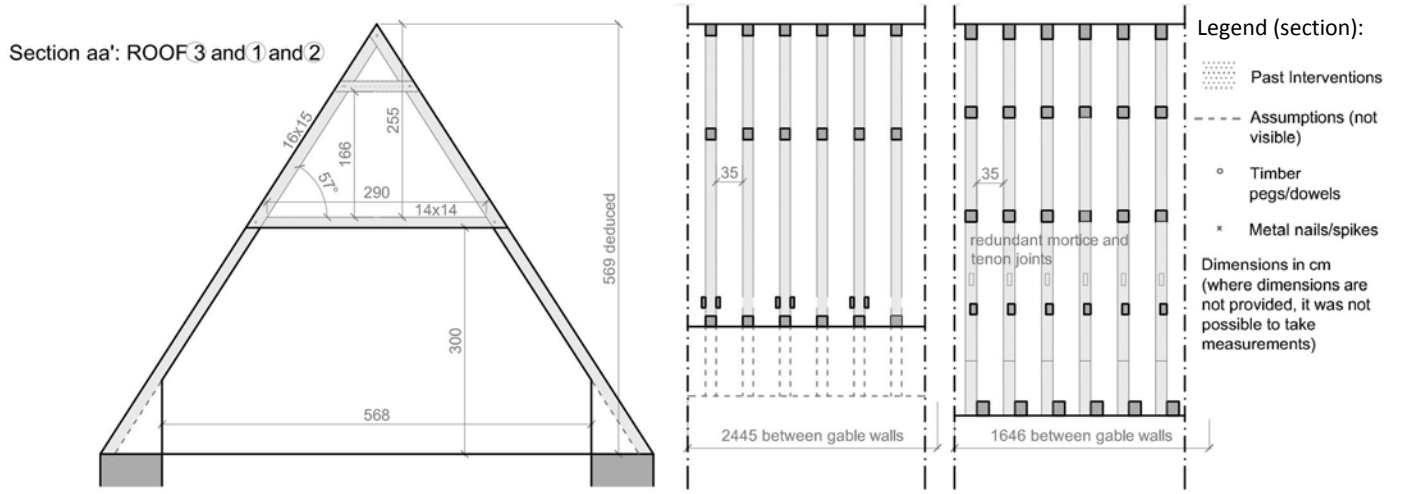
Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



Roof 1 and 2 from outside I:\Arch\A



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** PINKIE HOUSE | **Roof location** 1: long hall

Survey date(s) 09/10/2014 | See drawing: PKH-all-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 6.1 | Roof Height [m]: 4.6

Roof Pitch/es [°]: 52 | Roof Length [m]: 24.5

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.35

Type of Secondary Structure: sarking

Sarking boards: width [cm] 26 | thickness [cm] 3

Connection with lateral walls: None

Connection with gables: sarking interrupted (chimney), wall-plate

Roof Construction Period: From 1613 To | Identified by: Estimated

Roof General Description: Double pitch roof sandwiched between two gable walls, made of ashlar masonry, with other roofs intersecting on the West side. Composed of 50 frames with 3 collars each: 2 original and one added 1955. Some frames have vertical struts as well, connecting the rafters and the lower collars. The lower collars support the original early 17th century vaulted timber painted ceiling. As far as it's visible, the rafters simply sit on the wallhead and the space in-between them is infilled with rubble masonry up to the start of the painted ceiling.

Roofing Material: slate

Roofing Material Fixing: Metal nails, Timber Pegs

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 15 | B: 14 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description:

Wood Species: pinus sylvestris, except for, the pegs (both in joints and in sarking) which are quercus sp. | Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Partly in sequence, many double numbers

Signs of reused timbers:

Timber Treated ☑ for insects, in 1970s

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints and slates' fixing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features: Original timber painted ceiling underneath

Unfavourable conditions:

Accessibility limitations: Connection with wall not well visible

Past interventions: Struts added sometime in 18th century, judging from the dressing. The ceiling probably had problems already back then, and the struts were inserted to counteract the deflection of the lower collars, supporting the ceiling. Additional collars were added to one frame every two in 1955 for the same reason and probably solved the problem.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains on sarking. Insect attack on all timbers, but has been treated and looks inactive.



Humidity stains | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage	transversal opening	Intervened on	Primary
Unit Damage			
Element Damage			
Connection Damage	Disconnection, Splitting	Intervened on	Collateral



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient joints
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: disconnection | link | I:\Arch\A

Description of visible damage: Some joints between rafters and collars partly opened. Probably overall transversal opening. That's why new collars have been added. The problem seems to have been solved since the ceiling hasn't shown new signs of damage.

Other Notes:

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** PINKIE HOUSE | **Roof location** 2: SE of long hall

Survey date(s) 09/10/2014 | See drawing: PKH-all-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 5.68 | Roof Height [m]: 5.69

Roof Pitch/es [°]: 57 | Roof Length [m]: 3.96

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.35

Type of Secondary Structure: sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1613 To | Identified by: Estimated

Roof General Description: Gabled roof intersecting long hall. Composed of 9 frames with one collar each and 7 frames in intersection. Connection with wall not visible.

Roofing Material: slate

Roofing Material Fixing: Metal nails, Timber Pegs

Timber elements' Section Shape: Square with wanes

Rafter Scantling [cm] H: 16 B: 15 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed) | Bark ☑

Joint Types: lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Original timbers are all connected with mortice and tenon joints with timber pegs not flush. Collar added later has dovetail lapped joints with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types:

Carpentry Marks Description:

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roofing material fixing | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor ventilation, presence of pigeons/wasps/bats

Accessibility limitations

Past interventions: Some rafters doubles. Upper collar added.



Past interventions and wasps | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:		
Roof Damage					link
Unit Damage					
Element Damage					
Connection Damage					

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage | link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** PINKIE HOUSE | **Roof location** 3: old tower house

Survey date(s) 09/10/2014 | See drawing: PKH-all-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.44 | Roof Height [m]: 5.18

Roof Pitch/es [°]: 52 | Roof Length [m]: 16.46

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.42

Type of Secondary Structure: sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Rafter foot

Connection with gables:

Roof Construction Period: From 1575 To 1600 | Identified by: Estimated

Roof General Description: Gabled roof composed of 33 frames each with 3 collars and rafter feet (lower collar replaced in 19C?). Northern section of roof has ceiling attached under lower collar.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 20 | B: 15 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description: Original timbers are all connected with mortice and tenon joints with timber pegs not flush. Collar added later has dovetail lapped joints with metal nails.

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Partly in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof Structure | link I:\Arch\A



Roof Structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentery marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: Some rafters reinforced with timber. New tie-beams next to rafter foot, not connected with rafters. Collar substituted with a lower one. Steel ties added in some frames to hang new tie-beams from rafters.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Insect attack on some rafters, noit sure if active



Material degradation | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

DETAILED SURVEY **Building name** PINKIE HOUSE **Roof location** long hall

Survey date(s) 09/10/2016 09/03/2016 31/03/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings PKH-lh-1, PKH-lh-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
rafter	700	rectangular with wanes and bark	bending, compression	pinus sylvestris	hand axed
upper collar	200	rectangular with wanes and bark	bending, compression	pinus sylvestris	hand axed
lower collar	585	rectangular with wanes and bark	bending, tension		
intermediate collar	585	rectangular	bending, tension		machine sawn
strut	215	rectangular with wanes	tension		hand sawn
sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

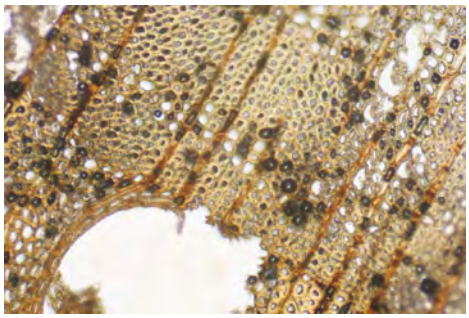
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings PKH-lh-1, PKH-lh-2

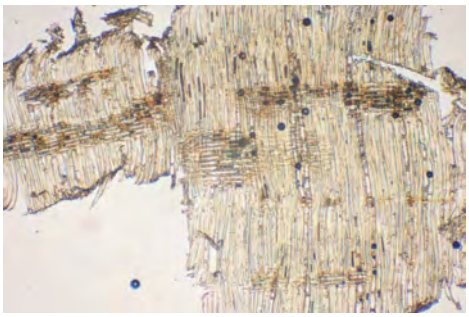
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter	Corner mortice & tenon	compression	wooden pegs	
rafter & upper/lower collars	Encounter mortice & tenon	compression, tension	wooden pegs	quercus sp.
rafter & intermediate collar	Encounter simple lap	tension	bolts	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

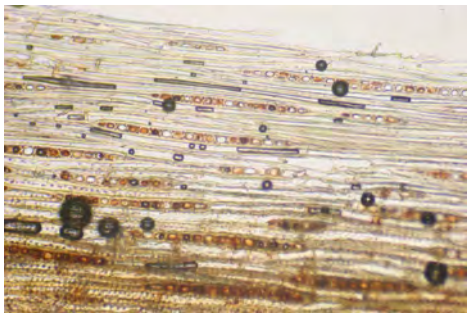
Microscopic identification of the timber species See drawing PKH-lh-2



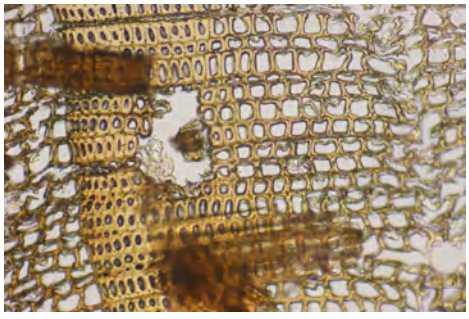
Peg rafter&collar: transv. section x100 I:\Arc



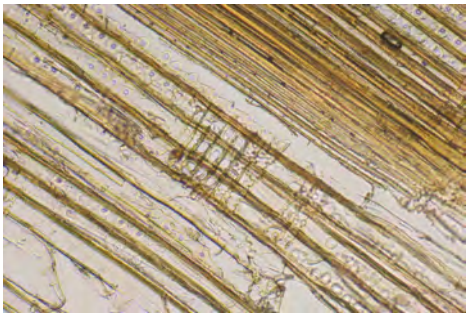
Peg rafter&collar: radial section x50 I:\Arc



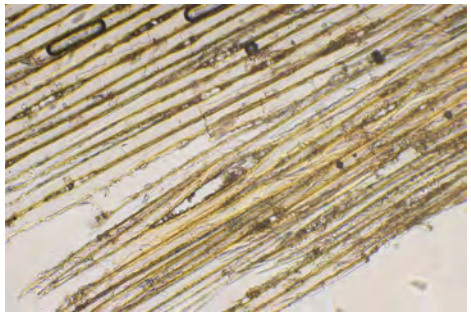
Peg rafter&collar: tang. section x100 I:\Arc



Rafter: transv. section x100 I:\Arc



Rafter: radial section x100 I:\Arc



Rafter: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing PKH-lh-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	N side	09/03/2016	11:20 am	14.8	48.7

roof space	N side	09/03/2016	11:20 am	14.8	48.7
roof space	S side	09/03/2016	11 am	14.9	48.8
attic space	N side	09/03/2016	10:20 am	19.5	36.5
attic space	S side	09/03/2016	10 am	17.8	39.5

Frame/Truss name north XI — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between upper collar & E rafter | Insect attack
Failed joints | Fungi attack
Other: E rafter twisted

Frame/Truss name XXVIII — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between upper collar & E rafter | Insect attack
Failed joints: between lower collar & W rafter | Fungi attack
Other

Frame/Truss name XXVIIII — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between upper collar & W rafter | Insect attack
Failed joints: between lower collar & W rafter | Fungi attack
Other: E rafter has reduced section due to old insect attack

Frame/Truss name north I — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area: E rafter
Joints with decayed peg: between upper collar & W rafter | Insect attack
Failed joints | Fungi attack
Other

Connection name between W rafter & lower collar — FrameTrussCode: PH-lh-nI

Mechanical Damage:	Type	Status	Role
Splitting: shear failure along grain	☑	unknown	primary
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☐		



rafter failed | I:\Ar

Estimated causes of primary damage:

Poor design ☑ fastener too close to borders
Poor maintenance ☐
External actions ☐
Material degrad. ☐
Poor construction ☐
Past interventions ☐
Other ☐

Description: part of rafter covering peg failed

Estimated damage level: rupture
Emergency intervention needed ☐

Frame/Truss name XXX — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints: between lower collar & W rafter | Fungi attack
Other

Frame/Truss name IIXXX — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area: W rafter

Joints with decayed peg: between upper collar & both rafters
Insect attack:
Failed joints:
Fungi attack:
Other:

Frame/Truss name IXXX — See drawing PKH-LH-2

Missing elements:
Elements with defects in critical area: both rafters
Joints with decayed peg:
Insect attack:
Failed joints: between lower collar & E rafter
Fungi attack:
Other:

Frame/Truss name north X — See drawing PKH-LH-2

Missing elements:
Elements with defects in critical area:
Joints with decayed peg:
Insect attack:
Failed joints: between lower collar & both rafters
Fungi attack:
Other:

Frame/Truss name non visible 1 — See drawing PKH-LH-4

Missing elements:
Elements with defects in critical area: E rafter
Joints with decayed peg: between upper collar & both rafters
Insect attack:
Failed joints: between lower collar & W rafter
Fungi attack:
Other: checks on both sides of both rafters

Element name A west rafter

Dating: original construction
Signs of reuse:
Timber treated: ☑ for insects, in 1970s
Accessibilityissues:
Past interventions: additional collar connecting the rafters & supporting the ceiling
Differences compared to other elements of the same type:
Section: nominal size (hxb) [cm]: 15x13.7 min. size (hxb) [cm]: 15x13.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre Slope of grain [%]: 3 tangential
Knots [min d/section h]: 2/16 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☑
Other defects:
Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack ☐ Type: Status:
Way of identification:
Fungi attack ☐ Type: Status:
Way of identification:
Corrosion ☐ Wet surface ☐ Other:

Mechanical Damage

Type — Status — Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☑ 9cm out of plomb — unknown
Estimated level of damage: initial Emergency interv. needed ☐
Mater.Degr. and Damage Extent:
Way of identification:

Estimated causes of primary damage
Poor design ☑ inadequate arrangement
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 16 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B upper collar

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13.2x10.5 min. size (hxb) [cm] 12.5x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 1/15 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☑ 9cm out of plomb unknown

Estimated level of damage initial Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point d

Moisture Content [%] 13 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 11.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C east rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues

Past interventions additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.5x14 min. size (hxb) [cm] 15x14 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 1/14 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119 lower than III



checks on both sides of rafter I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point f

Moisture Content [%] 14.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point g

Moisture Content [%] 15.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point h

Moisture Content [%] 16.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Connection name between E rafter & upper collar FrameTrussCode PH-lh-nv1

Mechanical Damage: Type Status Role

Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary



decayed peg, nothing left I:\Ar

Estimated causes of primary damage:

Poor design ☐ Poor maintenance ☐

External actions ☐ Material degrad. ☑

Poor construction ☐

Past interventions ☐

Other ☐

Description: decayed peg, nothing left

Estimated damage level: medium

Emergency intervention needed ☐

Frame/Truss name south I See drawing PKH-LH-3

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar and both rafters Insect attack

Failed joints between lower collar & W rafter Fungi attack

Other upper collar has reduced section due to old insect attack

Element name A west rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues lower end not visible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15x14 min. size (hxb) [cm] 15x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point i

Moisture Content [%] 18.1

Ultrasonic velocity [m/s] 2118

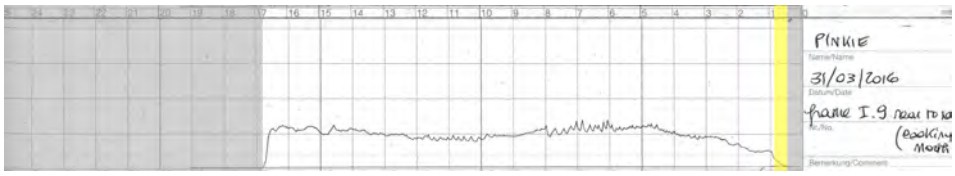
Density loss based on ultrasonic test [%] -30.6

Material Degradation based on Micro-drill [%] 2.3

Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point l

Moisture Content [%] 17.4

Ultrasonic velocity [m/s] 2116

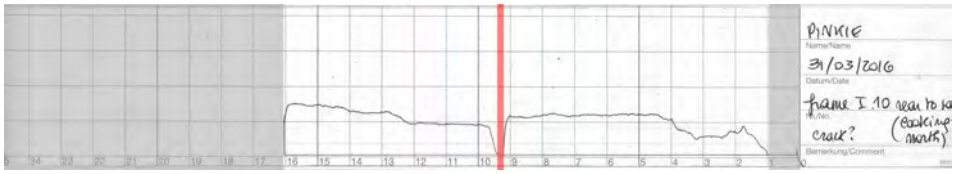
Density loss based on ultrasonic test [%] -30.5

Material Degradation based on Micro-drill [%] 1.7

Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point m

Moisture Content [%] 17.9

Ultrasonic velocity [m/s] 2003

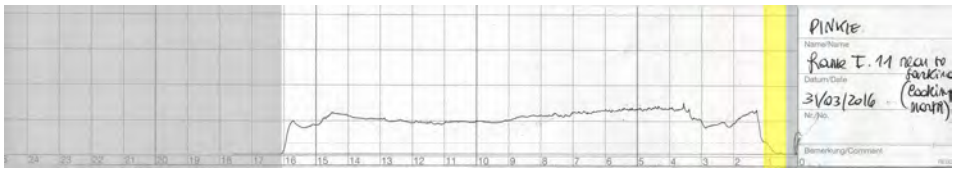
Density loss based on ultrasonic test [%] -26

Material Degradation based on Micro-drill [%] 3.8

Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point n

Moisture Content [%] 17.7

Ultrasonic velocity [m/s] 2267

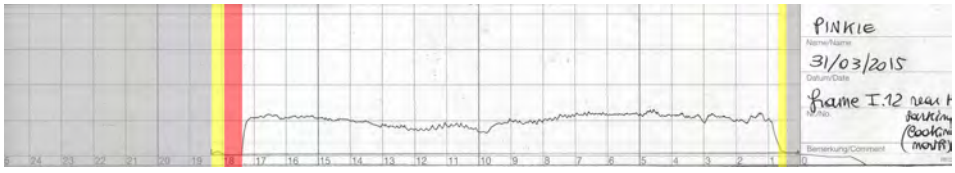
Density loss based on ultrasonic test [%] -36.5

Material Degradation based on Micro-drill [%] 6.2

Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point o

Moisture Content [%] 18.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B upper collar

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s - section reduced Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15x14 min. size (hxb) [cm] 14x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 3/14 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

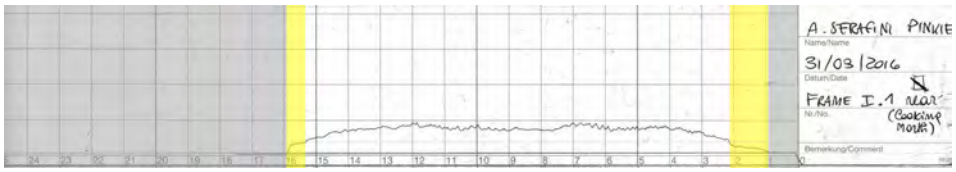
Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2226 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -34.9

Material Degradation based on Micro-drill [%] 9.3

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

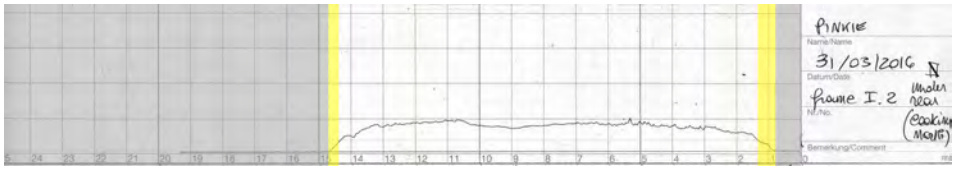
Moisture Content [%] 15.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2118 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -30.6

Material Degradation based on Micro-drill [%] 5.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

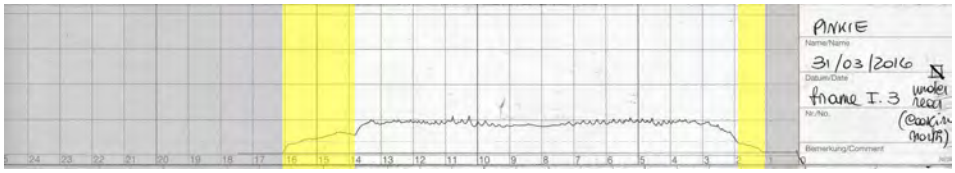
Moisture Content [%] 16 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2184 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -33.2

Material Degradation based on Micro-drill [%] 12.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C east rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues lower end not visible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.5x13.5 min. size (hxb) [cm] 14x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 4/13 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point d

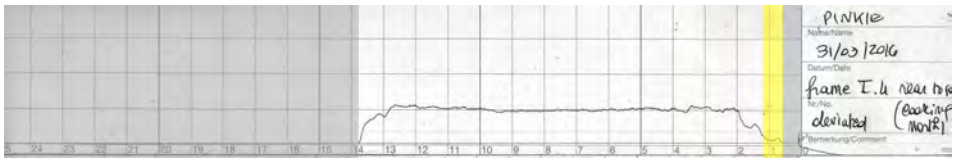
Moisture Content [%] 17.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2058 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -28.2

Material Degradation based on Micro-drill [%] 4.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

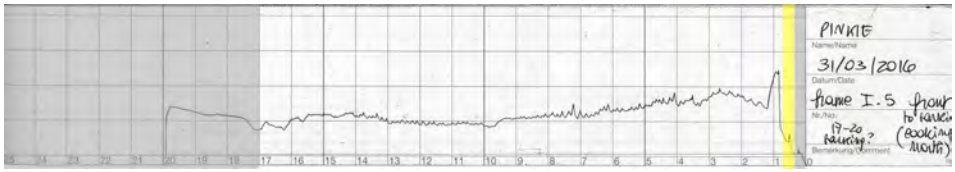
Moisture Content [%] 17.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2153 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -32

Material Degradation based on Micro-drill [%] 1.7

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

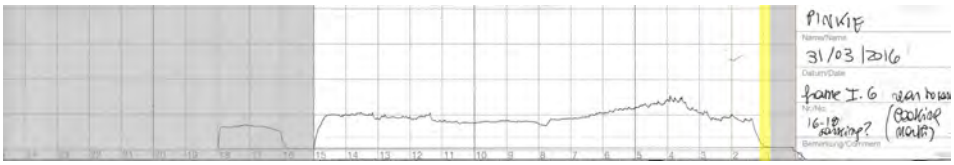
Moisture Content [%] 17 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2312 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -38.3

Material Degradation based on Micro-drill [%] 2.2

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point g

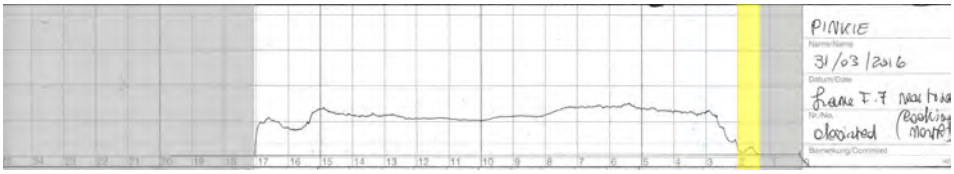
Moisture Content [%] 19.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2163 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -32.4

Material Degradation based on Micro-drill [%] 4

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point h

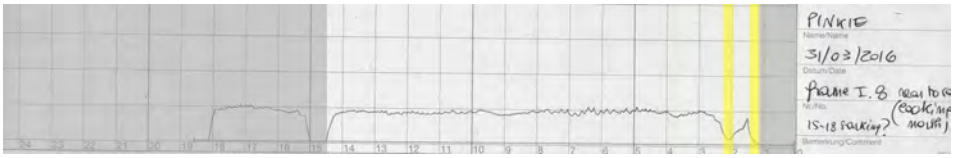
Moisture Content [%] 18.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2054 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -28.1

Material Degradation based on Micro-drill [%] 3.7

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Connection name between E rafter & lower collar | FrameTrussCode PH-lh-sl

Mechanical Damage: Type | Status | Role

Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary



failed peg | I:\Ar

Estimated causes of primary damage:

Poor design ☑ wrong geometry | Poor maintenance ☐

External actions ☐ | Material degrad. ☐

Poor construction ☐ | Description

Past interventions ☐ | peg failed because joint charged in tension. 8cm open

Other ☐ | Estimated damage level rupture

Emergency intervention needed ☐

Frame/Truss name south XIIII | See drawing PKH-LH-2

Missing elements | Elements with defects in critical area

Joints with decayed peg between upper collar & E rafter | Insect attack

Failed joints between lower collar & both rafters | Fungi attack

Other E rafter twisted

Frame/Truss name VXX | See drawing PKH-LH-2

Missing elements | Elements with defects in critical area E rafter

Joints with decayed peg between upper collar & W rafter | Insect attack

Failed joints between lower collar & E rafter | Fungi attack

Other E rafter has reduced section due to old insect attack

Frame/Truss name south X | See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: E rafter has reduced section due to old insect attack

Frame/Truss name south XII — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between upper collar & E rafter | Insect attack
Failed joints: between lower collar & E rafter | Fungi attack
Other: W rafter has been cut to put entrance

Frame/Truss name north VIII — See drawing PKH-LH-3

Missing elements | Elements with defects in critical area: W rafter
Joints with decayed peg: between upper collar & E rafter | Insect attack
Failed joints: between lower collar & W rafter | Fungi attack
Other

Frame/Truss name north VII — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints: between lower collar & E rafter | Fungi attack
Other: upper collar & W rafter have reduced section due to old insect attack

Frame/Truss name VI — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other: upper collar & W rafter have reduced section due to old insect attack

Frame/Truss name south V — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg: between upper collar and both rafters | Insect attack
Failed joints: between lower collar & W rafter | Fungi attack
Other: upper collar has reduced section due to old insect attack; E rafter has been cut to put window

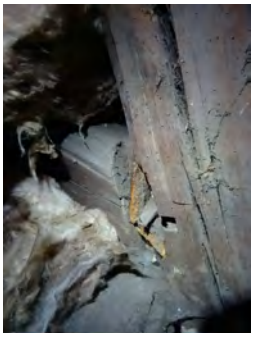
Frame/Truss name south IIII — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints: between lower collar & W rafter | Fungi attack
Other: upper collar & W rafter have reduced section due to old insect attack

Connection name between W rafter & lower collar — FrameTrussCode: PH-lh-sIIII

Mechanical Damage:

Type	Status	Role
Splitting: shear failure along grain ☑	unknown	primary
Crushing: compr. failure across grain ☐		
Disconnection due to shrinkage ☐		
Cracking ☐		
Fixing failure ☐		



Estimated causes of primary damage:

Poor design ☑ fastener too close to borders
Poor maintenance ☐
External actions ☐
Material degrad. ☐
Poor construction ☐
Past interventions ☐
Other ☐

Description: part of rafter covering peg failed. 4cm open

rafter failed I:\Ar

Estimated damage level: rupture

Emergency intervention needed ☐

Frame/Truss name south III — See drawing PKH-LH-2

Missing elements
Elements with defects in critical area
Joints with decayed peg: between upper collar and both rafters
Insect attack
Failed joints: between lower collar & both rafters
Fungi attack
Other: upper collar & W rafter have reduced section due to old insect attack

Frame/Truss name south II — See drawing PKH-LH-2

Missing elements
Elements with defects in critical area: W rafter
Joints with decayed peg: between upper collar and both rafters
Insect attack
Failed joints: between lower collar & both rafters
Fungi attack
Other: upper collar has reduced section due to old insect attack

Frame/Truss name centre II — See drawing PKH-LH-2

Missing elements
Elements with defects in critical area: E rafter
Joints with decayed peg: between upper collar & W rafter
Insect attack
Failed joints: between lower collar & W rafter
Fungi attack
Other

Frame/Truss name XIIIII — See drawing PKH-LH-2

Missing elements
Elements with defects in critical area: both rafters
Joints with decayed peg: between upper collar & E rafter
Insect attack
Failed joints
Fungi attack
Other

Frame/Truss name north II — See drawing PKH-LH-2

Missing elements
Elements with defects in critical area: both rafters
Joints with decayed peg: between upper collar & E rafter
Insect attack
Failed joints: between lower collar & W rafter
Fungi attack
Other

Frame/Truss name north III — See drawing PKH-LH-6

Missing elements
Elements with defects in critical area: both rafters
Joints with decayed peg: between upper collar & both rafters
Insect attack
Failed joints
Fungi attack
Other

Element name A west rafter

Dating: original construction | Signs of reuse:

Timber treated: ☑ for insects, in 1970s | Accessibilityissues: lower end not visible

Past interventions: additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 16x13.5 | min. size (hxb) [cm]: 14x12 | Single piece: ☑ | Jointed element: ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 4 | tangential

Knots [min d/section h]: 4/11 | single | Knotty element: ☐ | Defects in critical area: ☑ | Deep checks on both sides of element: ☐

Other defects: shakes all along element

Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack: ☐ | Type: | Status: | Way of identification:

Fungi attack: ☐ | Type: | Status: | Way of identification:

Corrosion: ☐ | Wet surface: ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage: | Emergency interv. needed: ☐

Mater.Degr. and Damage Extent: | Way of identification:

Element name B upper collar

Dating: original construction | Signs of reuse:

Timber treated: ☑ for insects, in 1970s | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 13x11.7 | min. size (hxb) [cm]: 13x11.5 | Single piece: ☑ | Jointed element: ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 9 | tangential

Knots [min d/section h]: 3/13 | single | Knotty element: ☐ | Defects in critical area: ☐ | Deep checks on both sides of element: ☐

Other defects:

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack: ☐ | Type: | Status: | Way of identification:

Fungi attack: ☐ | Type: | Status: | Way of identification:

Corrosion: ☐ | Wet surface: ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage: | Emergency interv. needed: ☐

Mater.Degr. and Damage Extent: | Way of identification:

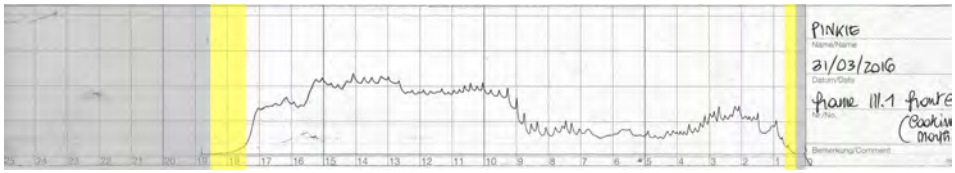


insects treatment | I:\Arc

Measurement Point a

Moisture Content [%] 19.4
Ultrasonic velocity [m/s] 2185
Density loss based on ultrasonic test [%] -33.3
Material Degradation based on Micro-drill [%] 7.3
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

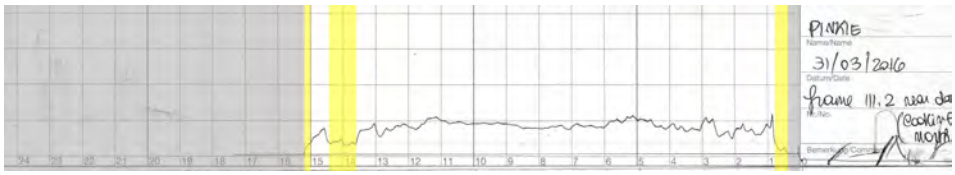


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 19.1
Ultrasonic velocity [m/s] 2051
Density loss based on ultrasonic test [%] -28
Material Degradation based on Micro-drill [%] 6.7
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C east rafter

Dating original construction
Signs of reuse
Timber treated ☑ for insects, in 1970s
Accessibilityissues lower end not visible
Past interventions additional collar connecting the rafters & supporting the ceiling
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 15.5x14.5 min. size (hxb) [cm] 15x14 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential
Knots [min d/section h] 4/15.5 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

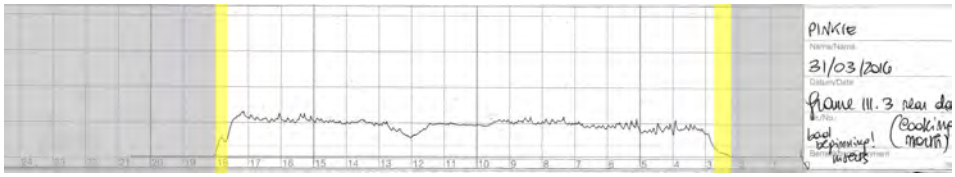
Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point c

Moisture Content [%] 18.1
Ultrasonic velocity [m/s] 1769
Density loss based on ultrasonic test [%] -16.8
Material Degradation based on Micro-drill [%] 4.4
Link to Micro-drill graph I:\Arc

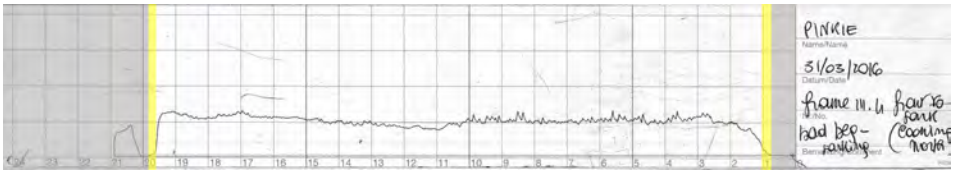
Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

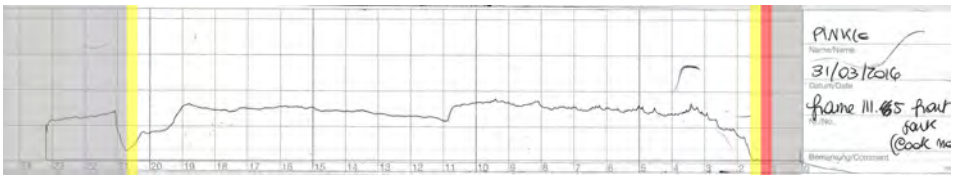
Moisture Content [%]	19.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]	2353	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐	
Density loss based on ultrasonic test [%]	-39.9				
Material Degradation based on Micro-drill [%]	2.8				
Link to Micro-drill graph	I:\Arc				



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%]	20.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]	2216	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐	
Density loss based on ultrasonic test [%]	-34.5				
Material Degradation based on Micro-drill [%]	4.7				
Link to Micro-drill graph	I:\Arc				



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%]	14.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐	
Density loss based on ultrasonic test [%]					
Material Degradation based on Micro-drill [%]					
Link to Micro-drill graph					

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point g

Moisture Content [%]	15.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐	
Density loss based on ultrasonic test [%]					
Material Degradation based on Micro-drill [%]					
Link to Micro-drill graph					

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point h

Moisture Content [%]	15.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐	
Density loss based on ultrasonic test [%]					
Material Degradation based on Micro-drill [%]					
Link to Micro-drill graph					

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name north IIII — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area

Joints with decayed peg: between upper collar & both rafters | Insect attack

Failed joints: between lower collar & W rafter | Fungi attack

Other

Frame/Truss name north V — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area: E rafter

Joints with decayed peg: between upper collar & E rafter | Insect attack:
Failed joints: between lower collar & both rafters | Fungi attack:
Other:

Frame/Truss name south VII — See drawing PKH-LH-2

Missing elements: | Elements with defects in critical area: E rafter
Joints with decayed peg: between upper collar & W rafter | Insect attack:
Failed joints: between lower collar & W rafter | Fungi attack:
Other:

Frame/Truss name south VIII — See drawing PKH-LH-2

Missing elements: | Elements with defects in critical area: W rafter
Joints with decayed peg: between upper collar & E rafter | Insect attack:
Failed joints: between lower collar & W rafter | Fungi attack:
Other:

Element name A west rafter

Dating: original construction | Signs of reuse:
Timber treated: ☑ for insects, in 1970s | Accessibilityissues: lower end not visible
Past interventions: additional collar connecting the rafters & supporting the ceiling
Differences compared to other elements of the same type:
Section: nominal size (hxb) [cm]: 18x14 | min. size (hxb) [cm]: 18x14 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 2 | tangential
Knots [min d/section h]: 8/18 | single | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐
Other defects:
Estimated Strength Class according to UNI 11119: III

Material degradation

Insect attack ☐ | Type: | Status:
Way of identification:
Fungi attack ☐ | Type: | Status:
Way of identification:
Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: | Emergency interv. needed ☐
Mater.Degr. and Damage Extent: | Way of identification:

Estimated causes of primary damage
Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 16.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Ultrasonic velocity [m/s]: | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 15.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B upper collar

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.5x11 min. size (hxb) [cm] 15x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 3/15 Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point d

Moisture Content [%] 16.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 16.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C east rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues lower end not visible

Past interventions additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19.5x15.5 min. size (hxb) [cm] 19x15 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 8 tangential

Knots [min d/section h] 1/16 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point f

Moisture Content [%] 16.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point g

Moisture Content [%] 16.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point h

Moisture Content [%] 17.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] ☐ Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Connection name between E rafter & upper collar FrameTrussCode PH-lh-sVIII

Mechanical Damage:	Type	Status	Role
Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary



decayed peg I:\Ar

Estimated causes of primary damage:

Poor design ☐ Poor maintenance ☐

External actions ☐ Material degrad. ☑

Poor construction ☐ Description

Past interventions ☐ decayed peg Estimated damage level initial

Other ☐ Emergency intervention needed ☐

Frame/Truss name IIIIV See drawing PKH-LH-5

Missing elements Elements with defects in critical area both rafters

Joints with decayed peg Insect attack

Failed joints between lower collar & W rafter Fungi attack

Other wound on E rafter

Element name A west rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues lower end not visible

Past interventions additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 14.5x13.2 min. size (hxb) [cm] 14x12.5 Single piece ☑ Jointed element ☐

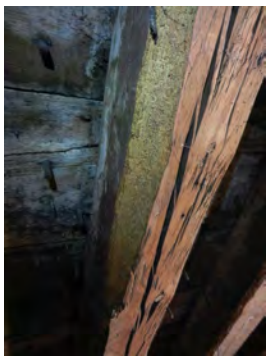
Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 4/15 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



treatment for insects I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point c

Moisture Content [%] 15.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 16.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B upper collar

Dating original construction Signs of reuse
Timber treated ☑ for insects, in 1970s
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 12x12 min. size (hxb) [cm] 12x11.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential
Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

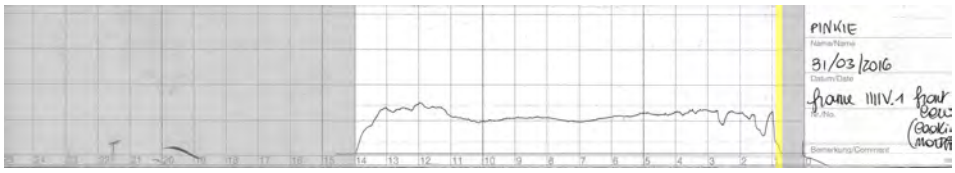
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%] 18.3
Ultrasonic velocity [m/s] 1950
Density loss based on ultrasonic test [%] -24
Material Degradation based on Micro-drill [%] 1.8
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 17.8
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C east rafter

Dating original construction
Signs of reuse
Timber treated ☑ for insects, in 1970s
Past interventions additional collar connecting the rafters & supporting the ceiling
Accessibilityissues lower end not visible
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 15x14 min. size (hxb) [cm] 14x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre
Slope of grain [%] 2 tangential
Knots [min d/section h] 4/14 single
Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐
Other defects wound in central section
Estimated Strength Class according to UNI 11119 II



Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type wound (injury to living tree) I:\Arc
Status
Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point f

Moisture Content [%] 16.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point g

Moisture Content [%] 15.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point h

Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name south XI See drawing PKH-LH-2

Missing elements Elements with defects in critical area E rafter

Joints with decayed peg between upper collar & E rafter Insect attack

Failed joints Fungi attack

Other

Frame/Truss name north XII See drawing PKH-LH-2

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar & E rafter Insect attack

Failed joints between lower collar & W rafter Fungi attack

Other

Frame/Truss name XXVII See drawing PKH-LH-4

Missing elements Elements with defects in critical area W rafter

Joints with decayed peg between upper collar & W rafter Insect attack

Failed joints Fungi attack

Other

Element name A west rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues lower end not visible

Past interventions additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 16x14.5 min. size (hxb) [cm] 16x14 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 3 | tangential

Knots [min d/section h]: 5/14 | single | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☑ 7cm out of plomb	unknown	

Estimated level of damage: initial | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point e

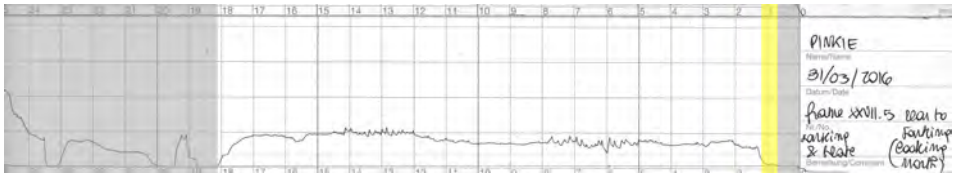
Moisture Content [%]: 18 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 2171 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -32.7

Material Degradation based on Micro-drill [%]: 2.7

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point f

Moisture Content [%]: 15 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]:

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point f

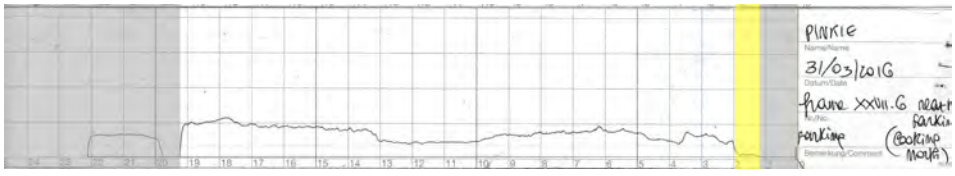
Moisture Content [%]: 18.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 2345 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -39.6

Material Degradation based on Micro-drill [%]: 4

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point g

Moisture Content [%]: 15.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]:

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point g

Moisture Content [%] 17.9 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point h

Moisture Content [%] 16 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B upper collar

Dating original construction | Signs of reuse

Timber treated ☑ for insects, in 1970s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.5x13.5 | min. size (hxb) [cm] 15x13 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 8 tangential

Knots [min d/section h] 3/14 single | Knotty element ☑ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



I:\Arc

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☑ 7cm out of plomb	unknown	

Estimated level of damage initial | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

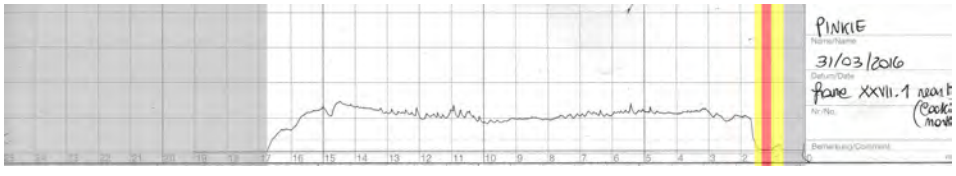
Moisture Content [%] 18 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1941 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -23.6

Material Degradation based on Micro-drill [%] 5.5

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 17 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point h

Moisture Content [%] 14.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C east rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s Accessibilityissues lower end not visible

Past interventions additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 16.7x13.7 min. size (hxb) [cm] 16.5x13.5 Single piece ☑ Jointed element ☐

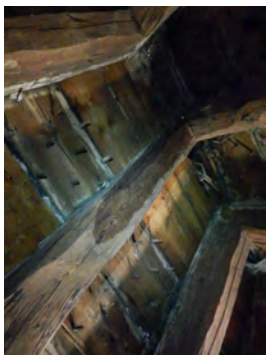
Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 4/14 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



wet surface close to upper end I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☑ 9cm out of plomb	unknown	

Estimated level of damage initial Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point b

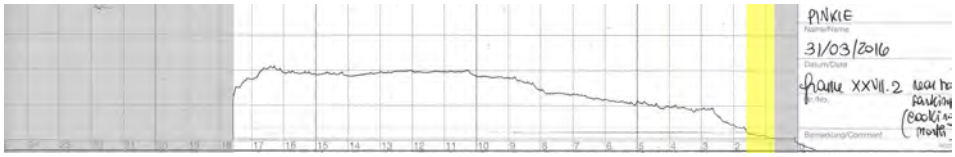
Moisture Content [%] 18.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2032 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -27.2

Material Degradation based on Micro-drill [%] 4.8

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

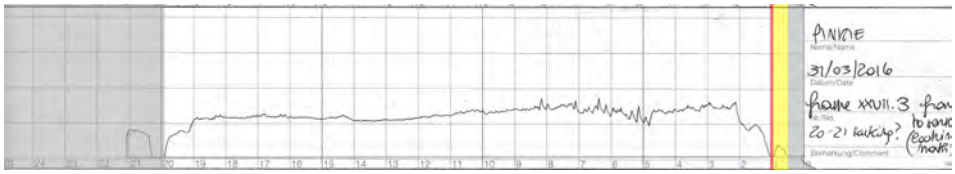
Moisture Content [%] 18.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2153 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -32

Material Degradation based on Micro-drill [%] 2.6

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

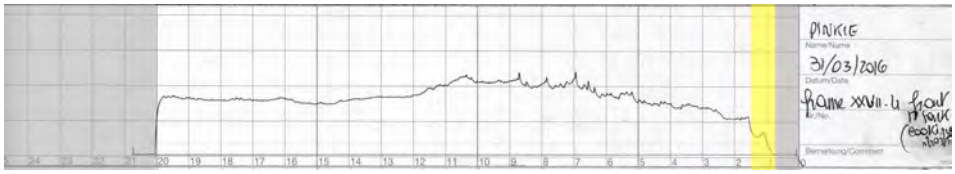
Moisture Content [%] 18.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2055 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -28.1

Material Degradation based on Micro-drill [%] 2.8

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Connection name between W rafter & lower collar | FrameTrussCode PH-lh-XXVII

Mechanical Damage:

Type		Status	Role
Splitting: shear failure along grain	☐		
Crushing: compr. failure across grain	☐		
Disconnection due to shrinkage	☐		
Cracking	☐		
Fixing failure	☑	unknown	primary



decayed peg, nothing left | I:\Ar

Estimated causes of primary damage:

Poor design ☐ | Poor maintenance ☐

External actions ☐ | Material degrad. ☑

Poor construction ☐

Past interventions ☐

Other ☐

Description: decayed peg, nothing left

Estimated damage level: medium

Emergency intervention needed ☐

Frame/Truss name north XIIII | See drawing PKH-LH-2

Missing elements | Elements with defects in critical area: E rafter

Joints with decayed peg: between upper collar & E rafter | Insect attack

Failed joints | Fungi attack

Other

Frame/Truss name XXVI | See drawing PKH-LH-2

Missing elements | Elements with defects in critical area

Joints with decayed peg: between upper collar & both rafters | Insect attack

Failed joints: between lower collar & E rafter | Fungi attack

Other

Frame/Truss name IVX — See drawing PKH-LH-2

Missing elements | Elements with defects in critical area: E rafter

Joints with decayed peg: between upper collar & both rafters | Insect attack

Failed joints | Fungi attack

Other

Frame/Truss name XVII — See drawing PKH-LH-5

Missing elements | Elements with defects in critical area

Joints with decayed peg: between upper collar & W rafter | Insect attack

Failed joints: between lower collar & W rafter | Fungi attack

Other

Element name A west rafter

Dating: original construction | Signs of reuse

Timber treated ☑ for insects, in 1970s | Accessibilityissues: lower end not visible

Past interventions: additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 16.5x13 | min. size (hxb) [cm]: 16x12.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 2 tangential

Knots [min d/section h]: 5/16 single | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☑ 19cm out of plomb | unknown

Estimated level of damage: medium | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Element name B upper collar

Dating: original construction | Signs of reuse

Timber treated ☑ for insects, in 1970s | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 12.5x11.7 | min. size (hxb) [cm]: 12x11.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 2 tangential

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☑ 19cm out of plomb	unknown	

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage medium Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Element name C east rafter

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1970s

Accessibilityissues lower end not visible

Past interventions additional collar connecting the rafters & supporting the ceiling

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x13 min. size (hxb) [cm] 13x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 3/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☑ 19cm out of plomb	unknown	

Estimated causes of primary damage

Poor design ☑ inadequate arrangement

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage medium Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

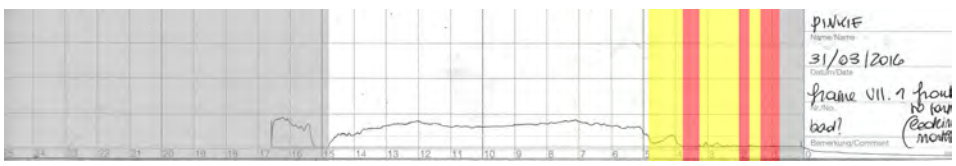
Moisture Content [%] 18.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 2165 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -32.5

Material Degradation based on Micro-drill [%] 26.3

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 15.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name XVIII See drawing PKH-LH-2

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar & both rafters Insect attack

Failed joints between lower collar & E rafter Fungi attack

Other

Frame/Truss name XVIIII See drawing PKH-LH-2

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar & W rafter Insect attack

Failed joints Fungi attack

Other

Frame/Truss name XX See drawing PKH-LH-2

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar & E rafter Insect attack

Failed joints Fungi attack

Other

Frame/Truss name XXII See drawing PKH-LH-2

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar & W rafter Insect attack

Failed joints between lower collar & E rafter Fungi attack

Other

Frame/Truss name XXIIII See drawing PKH-LH-2

Missing elements Elements with defects in critical area

Joints with decayed peg between upper collar & W rafter Insect attack

Failed joints Fungi attack

Other

Frame/Truss name	**XXIII**	See drawing PKH-LH-2	
Missing elements		Elements with defects in critical area	E rafter
Joints with decayed peg	between upper collar & W rafter	Insect attack	
Failed joints		Fungi attack	
Other	E rafter twisted and has reduced section due to old insect attack		

Frame/Truss name	**non visible 2**	See drawing PKH-LH-2	
Missing elements		Elements with defects in critical area	
Joints with decayed peg	between upper collar & both rafters	Insect attack	
Failed joints	between lower collar & both rafters	Fungi attack	
Other			

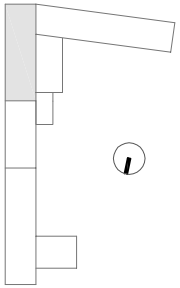
Frame/Truss name	**XIII**	See drawing PKH-LH-2	
Missing elements		Elements with defects in critical area	
Joints with decayed peg	between upper collar & E rafter	Insect attack	
Failed joints	between lower collar & E rafter	Fungi attack	
Other			

Plan 1:200

✳ **air humidity and temperature**

⊙ timber samples for species identification

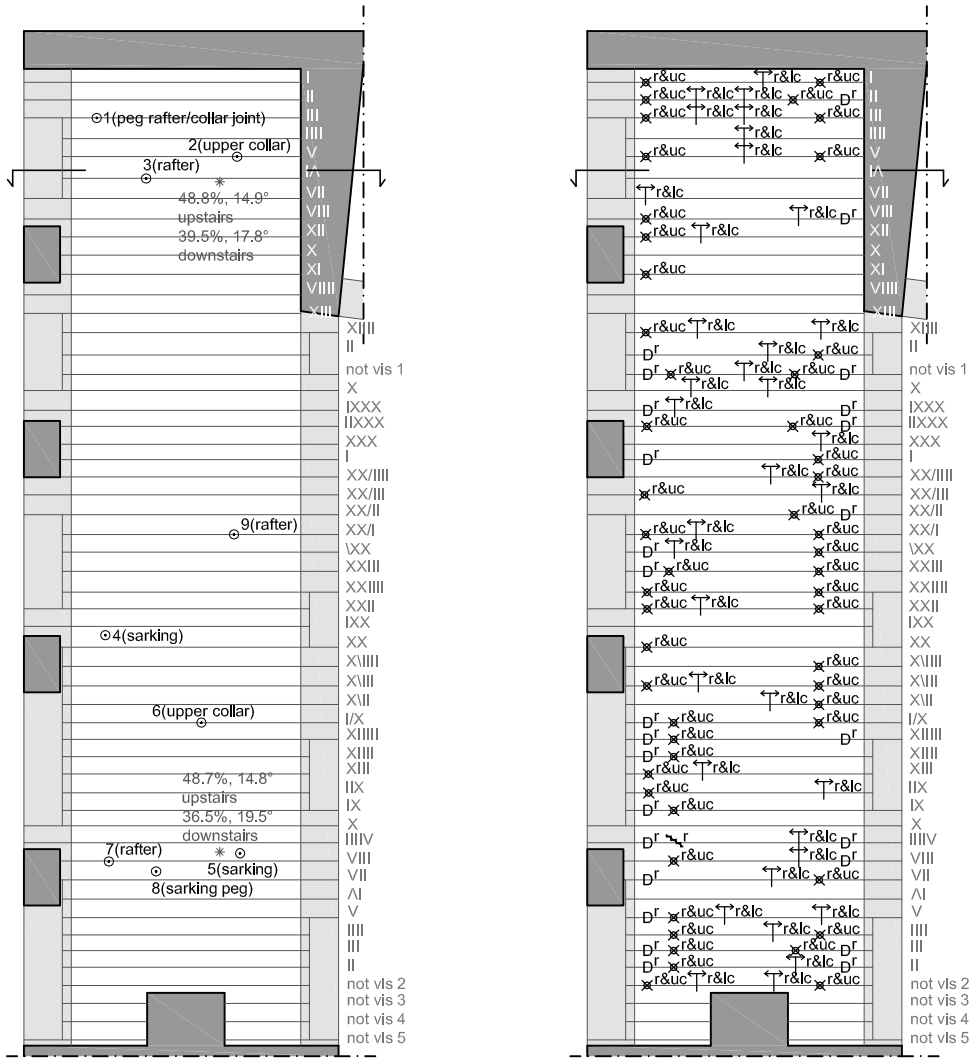
0 1 5



Visual Inspection:

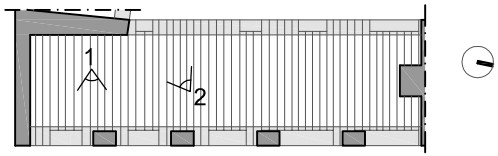
r=rafter
uc=upper collar
lc=lower collar
sk=sarking

D element with defects in critical area
wound (injury to living tree)
failed joint
decayed peg in joint

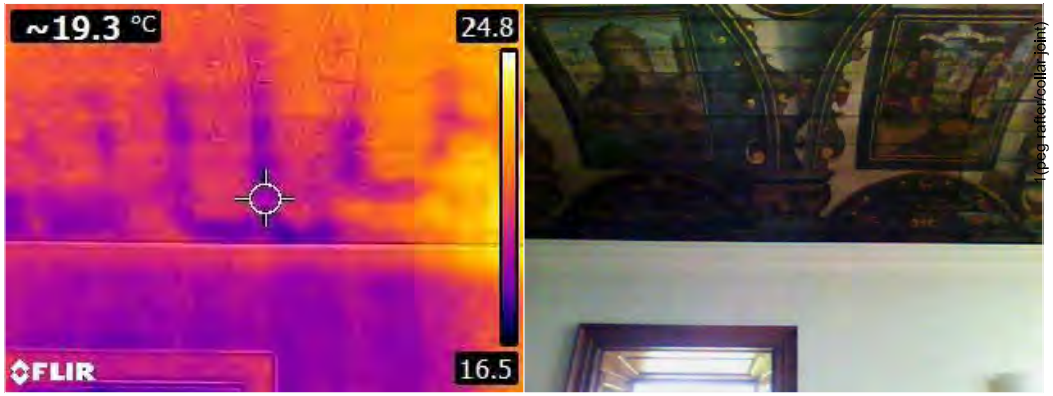


Themographic images

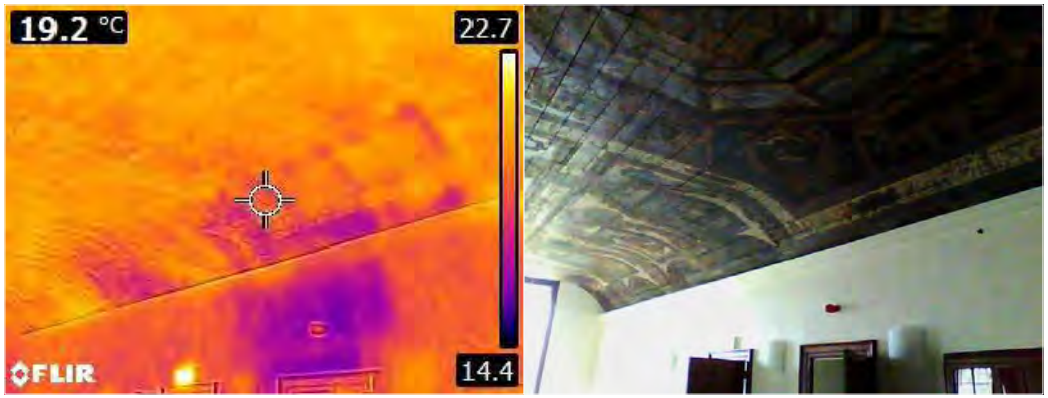
Plan 1:500



1: areas with lower temperature identify the position of the structure behind the painted timber panels



2: areas with lower temperature identify patches of humidity on the East wall



0 1 5

Sections 1:100 (looking North)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- decayed peg in joint
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

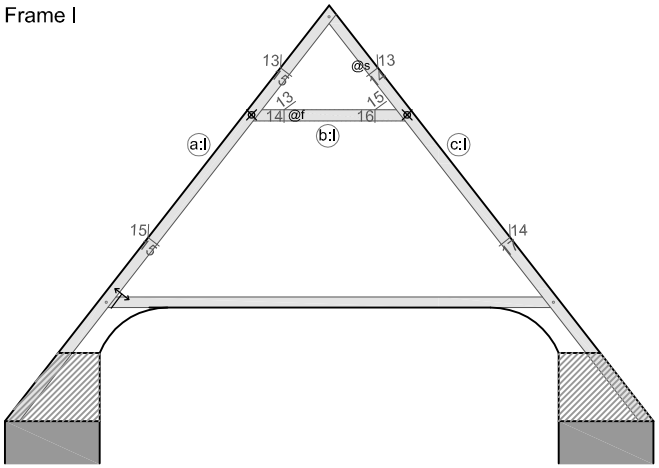
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

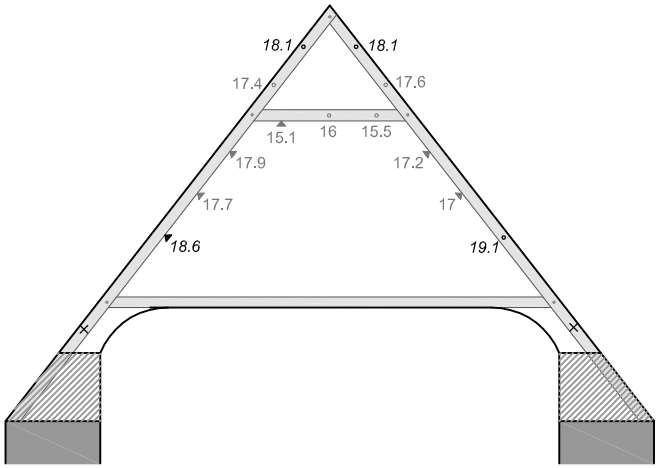
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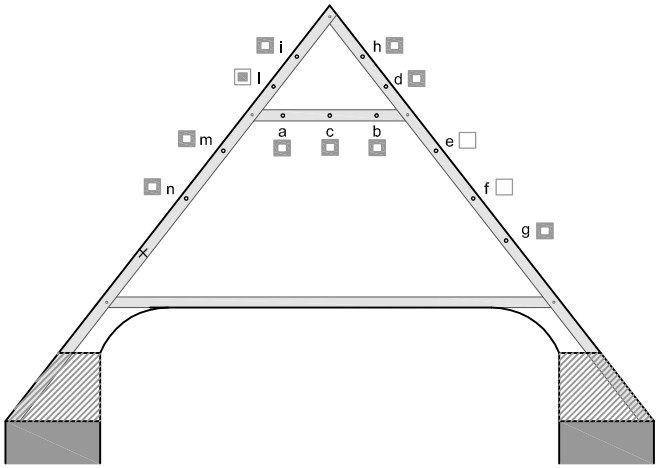
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & int. decay
- extensive decay

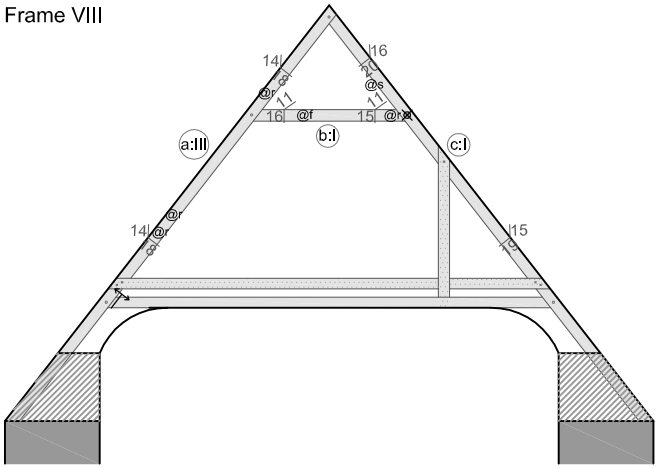
Frame I

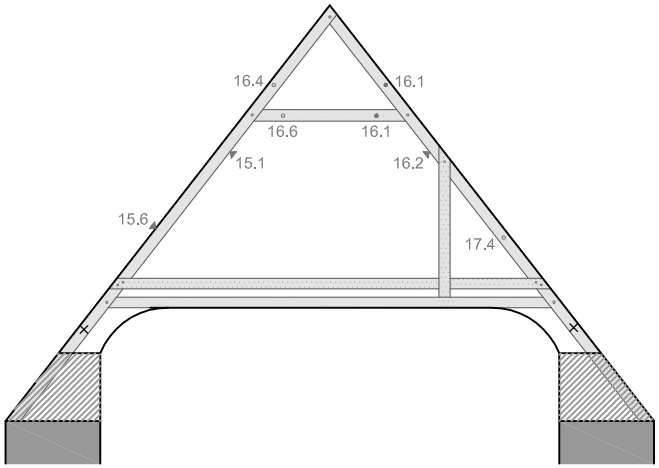






Frame VIII





0 1 5

Sections 1:100 (looking North)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- decayed peg in joint
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

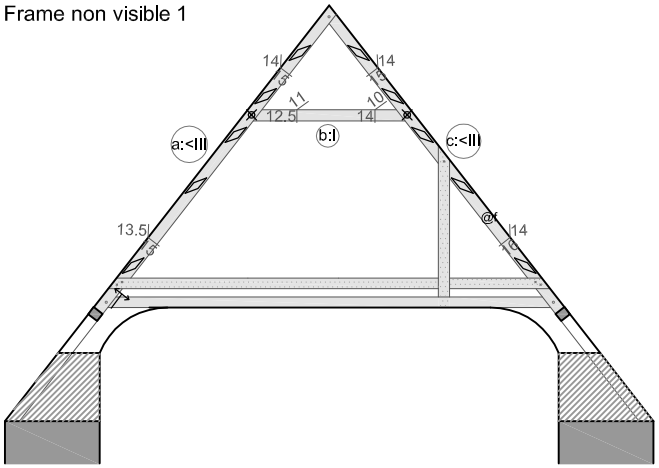
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

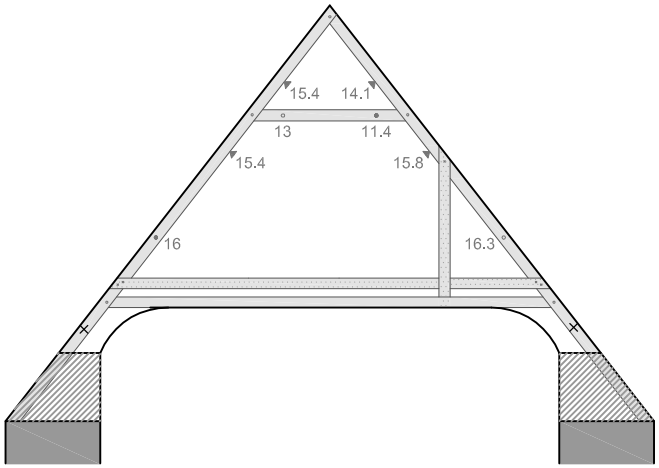
readings <18
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readings >20

Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

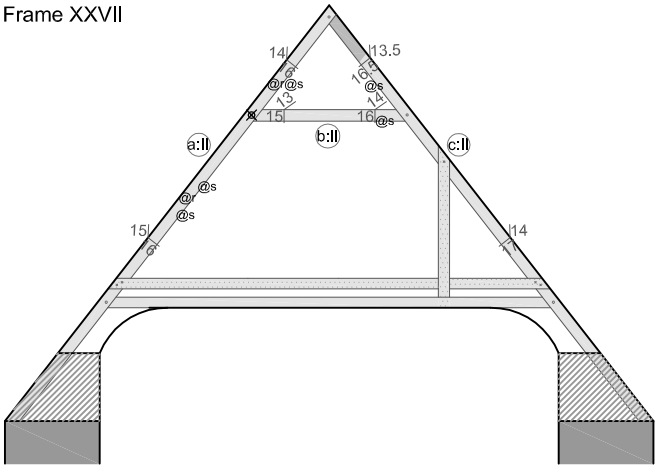
Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & int. decay
- extensive decay

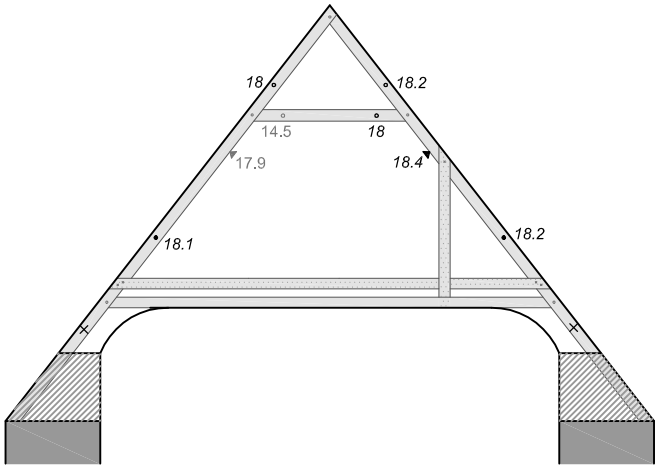
Frame non visible 1

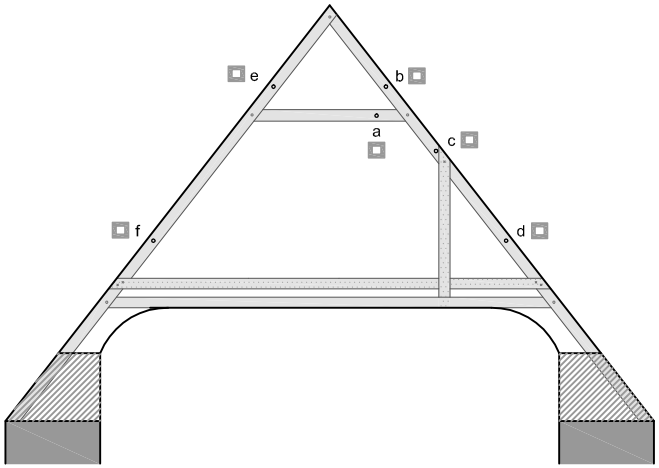




Frame XXVII







0 1 5

Sections 1:100 (looking North)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- decayed peg in joint
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

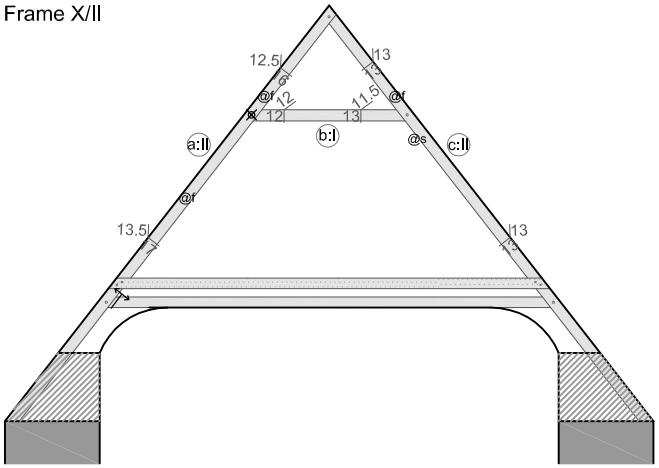
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

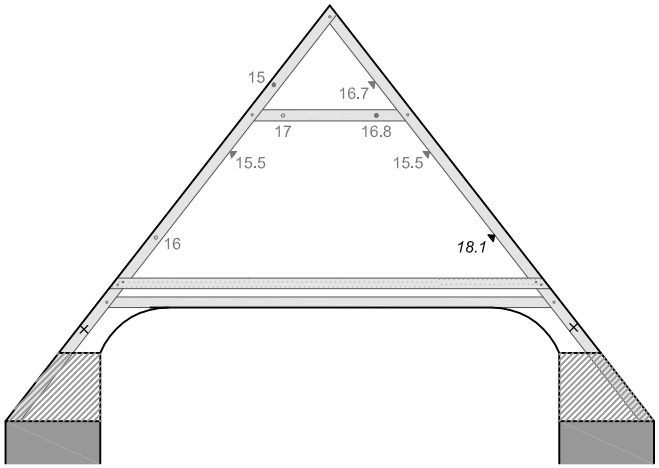
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readings >18
readings >20

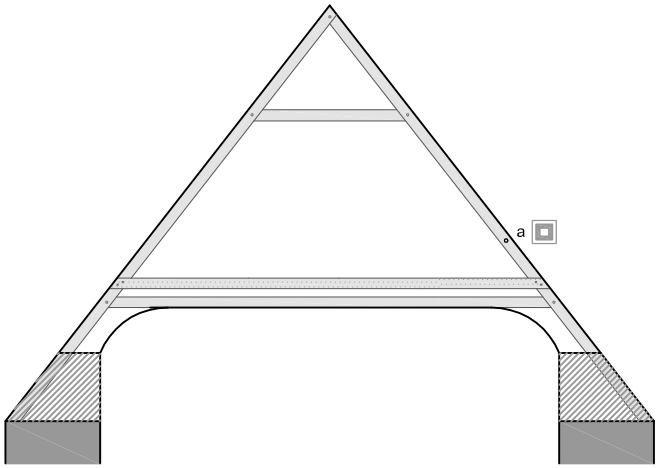
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & int. decay
- extensive decay

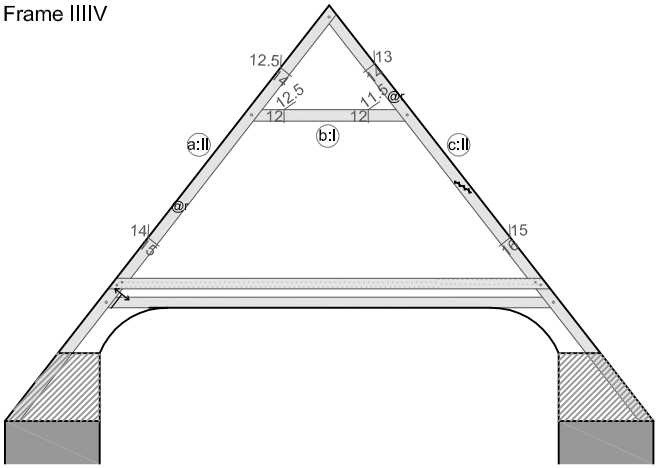
Frame X/II

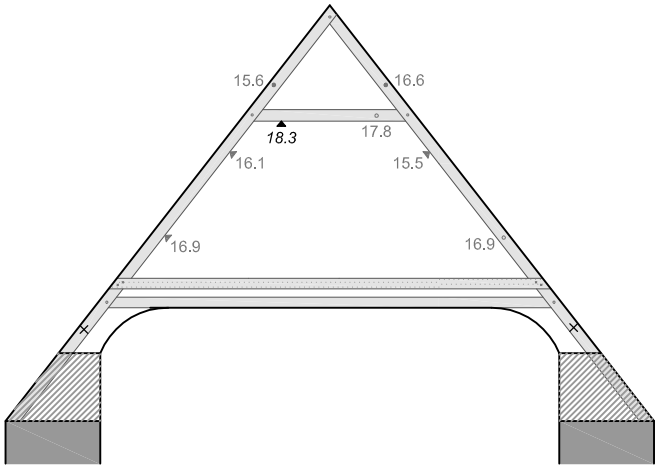


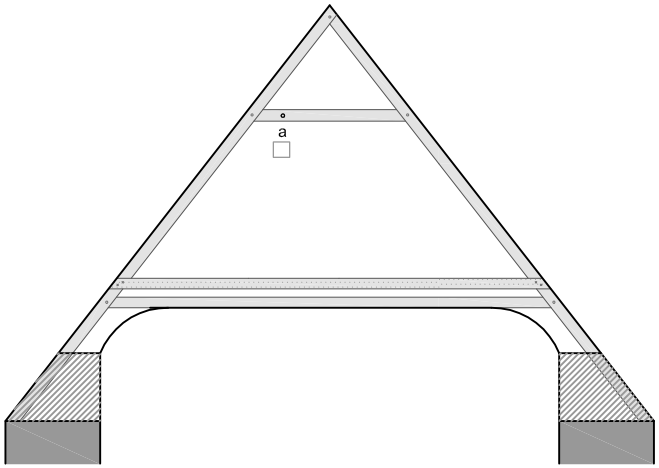




Frame IIIIV







0 1 5

Sections 1:100 (looking North)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- decayed peg in joint
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

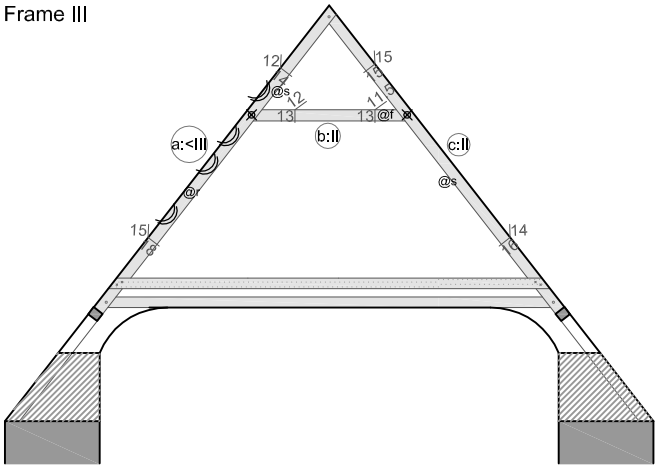
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

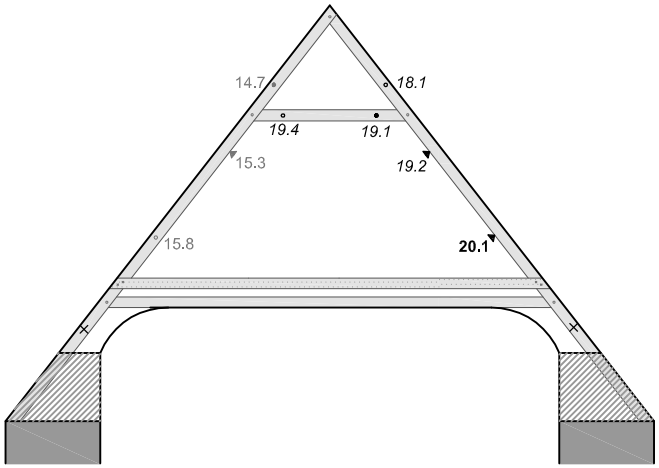
readings <18
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readings >20

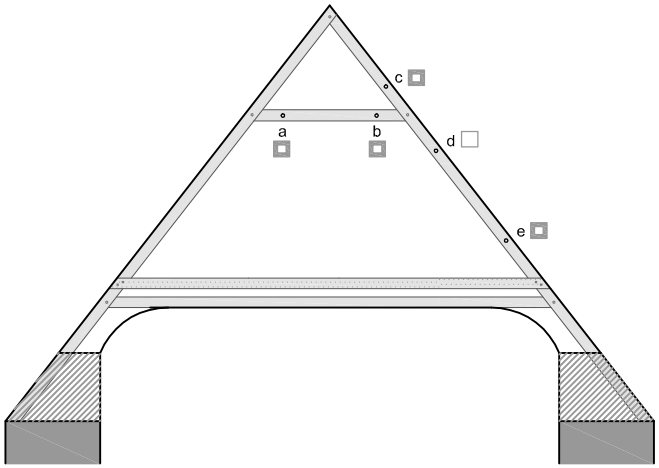
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- internal decay
- ext. & int. decay
- extensive decay

Frame III







0 1 5

Preliminary conclusions on stress calculations for roof timbers at Pinkie House, Musselburgh

1 Introduction

A structural analysis was carried out for the semi-trussed rafters which form the principal structural elements of the roof.

The analysis was based on survey drawings and member dimensions provided by Anna Serafini. Dimensional checks on the overall shape of the roof using trigonometry indicated that the survey was very accurate.

It was noted that there was considerable variation in the cross-sectional dimensions of both rafters and collars. Stress calculations were carried out for the complete range of sizes.

The analysis was carried out for a combination of dead load (due to the self weight of the structure and the weights of slates, sarking and painted ceiling), gravitational imposed load (due to snow) and imposed wind load. The values of snow and wind load were appropriate for the latitude and location of the building but it was noted that, in view of the pitch of the roof, the likelihood of significant snow load was small.

The analysis was based on the following assumptions:

- that the rafters were continuous from apex to wallhead
- that the joints between the collars and the rafters behaved as hinges
- that no significant internal force passed through the apex joint

Due to lack of access it was not possible to make a precise assessment of the support conditions at the junctions between the wallhead and the lower ends of the rafters. Two separate analyses were therefore carried out, one based on the assumption that no horizontal reaction occurred at the wallhead and one on the assumption that sufficient horizontal reaction could be developed to eliminate bending moment in the lowest sections of the rafters. It is likely that the actual behaviour of the roof lies somewhere between these two extremes.

For each of the analyses a full set of internal forces was evaluated and bending moment and shear force diagrams were drawn. Maximum combined bending and axial stresses were evaluated from these. The likely levels of shear stress in the oak pegs at the junctions between the lower collars and the rafters were also assessed.

A visual inspection was carried out from within the interior of the roof-space and the following noted:

- that the overall geometry of the roof had been preserved, indicating that the structure was fulfilling its support function adequately. There was no

evidence of sagging or other movement which would indicate that the structure was failing to provide the necessary support for the roof covering.

- that, relatively recently, the lower collars had been augmented by the insertion of additional timber elements. These appeared to be relieving the original lower collars of all structural functions other than that of providing support for the underlying painted ceiling.
  For the purposes of the structural analysis (i.e. calculation of internal forces) it was assumed that the functions of both sets of lower collars were combined. For the stress calculations, it was assumed that the internal forces were carried by the original collars only.
- that the tendons of some of the original collars had pulled out from the mortices in the rafters but that this did not appear to have caused significant distortion of the roof surface.

2 Results of the calculations

2.1 Assuming no horizontal reactions at the wallhead

It was found that:

- the highest stresses occurred in the rafter elements at the location of the junction with the lower collars. These stresses were local and diminished rapidly with distance from the collar joint.
- the highest stresses (both combined bending and axial stress in the rafters and shear stress in the oak pins) were within the failure strengths of the timber but were close to the failure strengths. In other words, that the factor of safety against strength failure was minimal.
- the tie force in the lower collars was high (around 10 kN).
- failure of the joint between the lower collar and the rafter would cause that particular frame to collapse. It would, of course, derive support from adjacent frames through connection by the sarking, but only if the adjacent frames had an adequate margin of strength.

2.2 Assuming sufficient horizontal reaction at the wallhead to minimise bending in the lower section of the rafters

It was found that for this support condition the combined stresses in the rafters were significantly lower than the probable failure strength of the timber (around 10% of the failure strength).

3 Conclusions

1 The analysis showed that the roof geometry and timber sizes are adequate for all conditions of support but marginal in the absence of a connection at the wallhead which is capable of producing a significant horizontal reaction.

2 In view of the good overall condition of the roof it seems probable that significant horizontal reaction is in fact being developed at the junctions between the wallheads and the rafters.

3 It was found that the integrity of the joint between the lower collar and the rafter was critical to the structural functioning of the roof if no horizontal reaction was present at the wallhead. The fact that some of the connections appeared to have failed without causing significant distress to the overall shape of the roof is a further indication that the rafter/wallhead joint is providing a significant horizontal reaction.

4 It is reasonable to conclude that if, in future, there is any indication of structural failure (e.g. by the development of sagging in the roof surface) it is likely that the cause of this will be movement in the rafter/wallhaead junction producing a reduction in the horizontal reaction.

5 The most critical structural aspect of the roof is the junction of the rafters and the wallhead.

Professor Angus Macdonald
University of Edinburgh
+44 131 665 2131
+44 7889 514 939
angus.macdonald@ed.ac.uk
http://www.eca.ed.ac.uk/eca-home/angus-macdonald

9 June 2016

EDINBURGH ST ANDREW'S AND ST GEORGE'S CHURCH

Location: EDINBURGH, CITY OF | EDINBURGH (EDINBURGH, CITY OF)

X coordinate: 325425 Y coordinate: 674098

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: CHURCH

Rcahms ID: 52433

HS Listing: A

Original Use: Church

Current Use: Church

Freestanding: ☑ N. of floors above ground level: 1 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1782	1784		HS

People involved:

Last Name	First Name	Role
FRAZER	MAJOR ANDREW	ARCHITECT
KAY	DAVID	ARCHITECT

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1787		STEEPLE	HS

People involved:

Last Name	First Name	Role
STEVENS	ALEXANDER THE ELD	ARCHITECT

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1953		INTERIORS	HS

People involved:

Last Name	First Name	Role
ESME	GORDON	ARCHITECT

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1976	1979	INTERIORS	HS

People involved:

Last Name	First Name	Role
HURD & PARTNERS	ROBERT	ARCHITECT

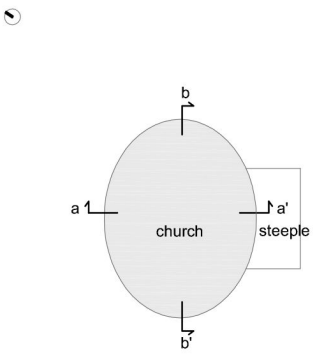
Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2003	2004	INTERIORS AND VODAPHONE PLANT INSTALLED IN ROOF SPACE	CHURCH ARCHITECT

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
GIFFORD J. & CHRISTOPHER WILSON	1984	☐	THE BUILDINGS OF SCOTLAND COLLECTION: EDINBURGH	

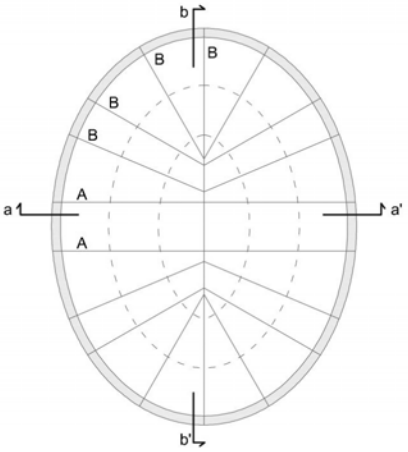
Suggestions for further research:



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

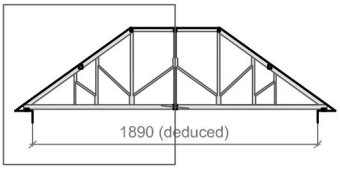
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks

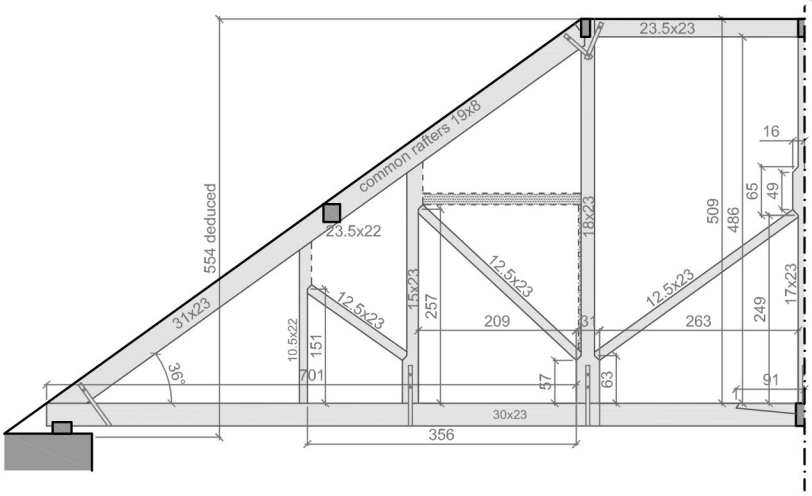


Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa': Truss A

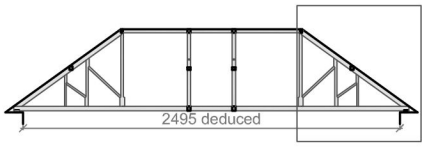


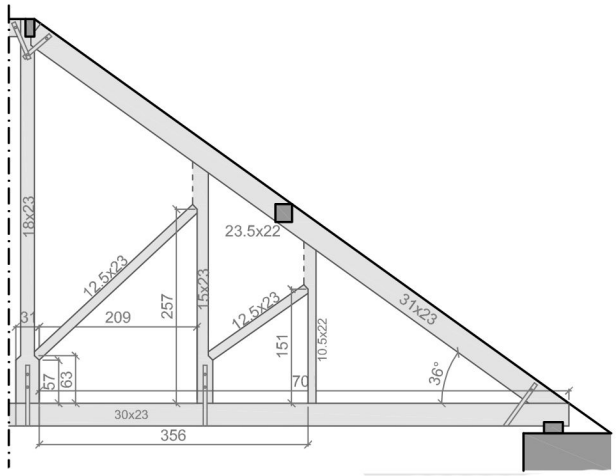


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb': Truss B





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** EDINBURGH ST ANDREW'S AND ST GEORGE'S | **Roof location** Church main hall

Survey date(s) 03/07/2015 | See drawing: SASGC-MH-1

Roof Geometry: Conical, Flat

Roof Max Span [m]: 18.9 | Roof Height [m]: 5.5

Roof Pitch/es [°]: 36 | Roof Length [m]: 25

Type of Primary Structure: 3D framing

Truss ☑ OTHER

Frame ☐

Average Distance in between Primary Structure [m]: 2.75

Type of Secondary Structure: common rafters, purlins, sarking

Sarking boards: width [cm] | thickness [cm]: 2.3

Connection with lateral walls: Wall-plate

Connection with gables: no gables

Roof Construction Period: From 1782 To 1784 Identified by: Estimated

Roof General Description:

It's an elliptical space, with two main 'queen' trusses and radial trusses on the sides. The queen trusses have two additional lateral posts and a central one. The structure is quite homogeneous, it doesn't look like it has been much altered.

Roofing Material: lead, slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 31 B: 23 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-sawn) Bark ☐

Joint Types: joggle, mortice and tenon, scarf

Fasteners Types: Metal bolt, Metal strap, Timber dowel

Joints description:

All mortice and tenon, with timber dowels and metal straps. Tie-beams have simple scarf joints.

Wood Species: pinus sylvestris

Way of identification: direct micro

Carpentry Marks Types: small chiseled roman numerals

Carpentry Marks Description:

only a few visible

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Metals straps and bolts in some joints - some look original some are more recent. Some metal brackets around tie-beams (later interventions)

Dendrochronology:



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Joints link I:\Arch\A



Timber elements' dressing link I:\Arch\A



Carpentry marks link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourablec onditions

Accessibility limitations

Past interventions: Few metal straps have been added to reinforce the joints between posts and upper beams (in 2003/4), whilst metal straps have been added around the tie-beams, probably earlier (50s or 70s?). The sarking on the slopes looks original, the one on the platform has been replaced.



Past interventions | link | I:\Arch\A

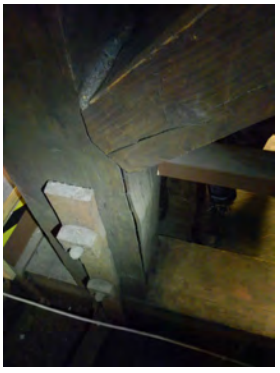
Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☐

Some humidity stains on sarking



Humidity stains on sarking | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks	Unknown	
Connection Damage			



Cracks in post and strut | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: Cracks in a few elements: a strut, a post and a rafter. A thorough visual inspection of all the roof structure should be carried out to make hypotheses on the causes.

link

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

DETAILED SURVEY **Building name** EDINBURGH ST ANDREW'S AND ST GEORGE'S CHURCH **Roof location** Church main hall

Survey date(s) 03/02/2016 14/03/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SASGC-MH-1, SASGC-MH-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafters	860	rectangular	bending, compression	pinus sylvestris	hand sawn
Tie-beam	2010	rectangular	bending, tension	pinus sylvestris	hand sawn
Upper beam	590	rectangular	bending, compression		hand sawn
Big posts	510	rectangular	tension	pinus sylvestris	hand sawn
Medium posts	320	rectangular	shear, tension		hand sawn
Small posts	215	rectangular	compression, shear		hand sawn
Big strut	325	rectangular	bending, compression		hand sawn
Medium strut	285	rectangular	bending, compression		hand sawn
Small strut	155	rectangular	bending, compression	pinus sylvestris	hand sawn
Purlin		rectangular	bending, compression	pinus sylvestris	hand sawn
Common rafter	860	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
Sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

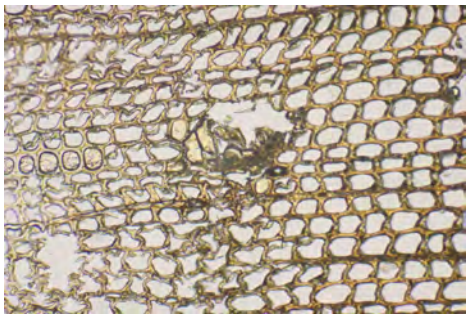
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SASGC-MH-1, SASGC-MH-2

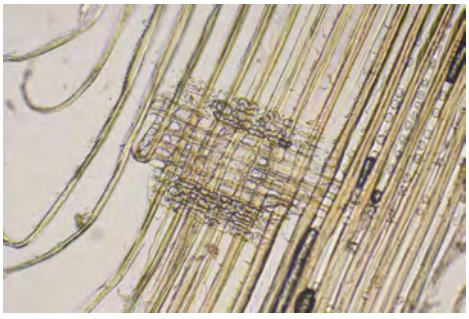
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & tie-beam	Corner mortice & tenon	compression, shear	none	
rafter & big post	Corner double step	compression, shear	metal straps	
posts & struts	Encounter mortice & tenon with joggles	compression, shear		
big/medium posts & tie-beam	Encounter mortice & tenon	tension	metal straps	
big posts & upper beam	Corner mortice & tenon	shear	metal straps	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

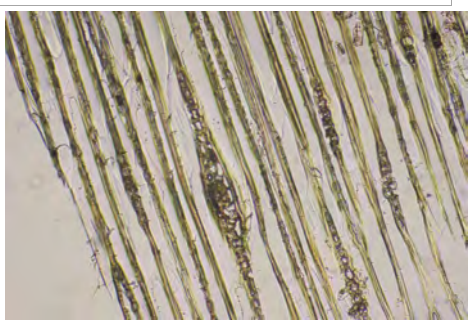
Microscopic identification of the timber species See drawing SASGC-MH-2



Post: transv. section x100 I:\Arc



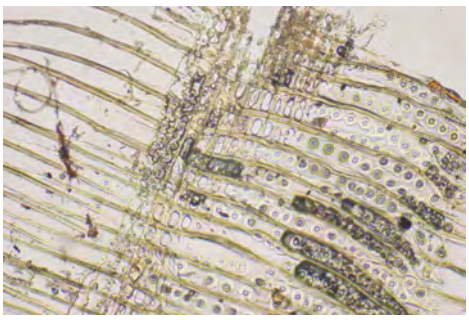
Post: radial section x100 I:\Arc



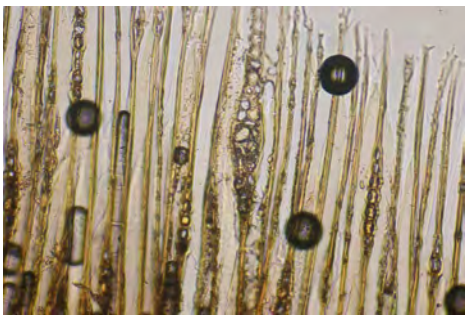
Post: tang. section x100 I:\Arc



Rafter: transv. section x100 I:\Arc



Rafter: radial section x100 I:\Arc



Rafter: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing SASGC-MH-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	W side	03/02/2016	3 pm	13.3	55.3

roof space	centre	03/02/2016	2:20 pm	13.8	51.6
roof space	E side	03/02/2016	2:40 pm	12.5	56.4

Frame/Truss name central west — See drawing SASGC-MH-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints: between S small post & small strut | Fungi attack

Other: cracks in lateral post e, strut d, rafter r

Element name A tie-beam

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: lower face not visible because of ceiling

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 30.5x22 | min. size (hxb) [cm]: 30x22 | Single piece ☐ | Jointed element ☑

Strength affecting defects

Pith location: centre | Slope of grain [%]: 6 | tangential

Knots [min d/section h]: 10/30 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II



scarf joint at centre of tie-beam | I:\Arc

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a			
Moisture Content [%]	14.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	14.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	11.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	14.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point e			
Moisture Content [%]	13.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point f			
Moisture Content [%]	14.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name B south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: upper part only visible from tie-beam level

Past interventions: metal straps around side and lower faces

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 30.7x22.7 | min. size (hxb) [cm]: 30x22.5 | Single piece ☑ | Jointed element ☐

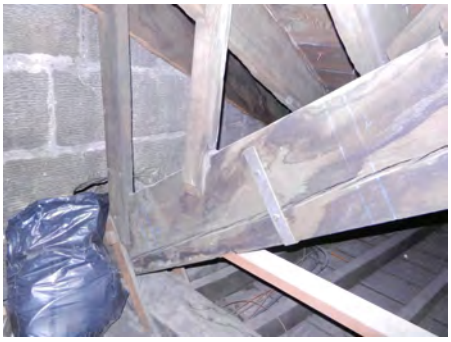
Strength affecting defects

Pith location: centre | Slope of grain [%]: 4 | tangential

Knots [min d/section h]: 3.5/22 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I



lower part of rafter | I:\Arc

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 13.9 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 13.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name C south small post

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 12.5x22.5 | min. size (hxb) [cm]: 10x22.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 5 | tangential

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I



joont with rafter | I:\Arc

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 8.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 10.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D south small strut

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 10x22.5 min. size (hxb) [cm] 10x22.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential
Knots [min d/section h] 6/10 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 lower than III


big knot on side I:\Arc

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑ compression	unknown	unknown
Crushing ☐		
Other ☐		

Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☑ bell tower pushing?

Measurement Point a
Moisture Content [%] 12.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 15.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name E south medium post

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 18.7x22 min. size (hxb) [cm] 15x22 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 2 | tangential

Knots [min d/section h]: 0.5/22 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: lower than III



crack close to bottom end | I:\Arc

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

	Type	Status	Role
Deformation ☐			
Cracks ☑	shear, tension	unknown	unknown
Crushing ☐			
Other ☐			

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☑ bell-tower pushing?

Measurement Point a

Moisture Content [%]: 12.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 13.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name F south medium strut

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 11.2x22.5 | min. size (hxb) [cm]: 11x22.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 6 | tangential

Knots [min d/section h]: 4.5/22.5 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

	Type	Status	Role
Deformation ☐			
Cracks ☐			
Crushing ☐			
Other ☐			

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%] 12.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 12.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name G south big post

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues upper part only visible from tie-beam level

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19.8x22.7 min. size (hxb) [cm] 17x22 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 7 tangential

Knots [min d/section h] 5/23 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects shakes all along upper part

Estimated Strength Class according to UNI 11119 lower than III



shakes in upper part I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 13.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name H south big strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x22.7 min. size (hxb) [cm] 13x22.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 4/13 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 13.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 14.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c		
Moisture Content [%] 13.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name I central post

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues upper part only visible from tie-beam level

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 21x22 min. size (hxb) [cm] 16x22 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential

Knots [min d/section h] 3.5/18.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 13.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 14.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name L north big strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12x22 min. size (hxb) [cm] 12x22 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 2/12 Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 13.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name M north big post

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues upper part only visible from tie-beam level

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 21.1x21.5 min. size (hxb) [cm] 18x21 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 4 tangential

Knots [min d/section h] 3/18 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



joints with struts I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name N north medium strut

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12x22.5 min. size (hxb) [cm] 12x22.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 5.5/15 group Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 13.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name O north medium post

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 16.4x22.5 min. size (hxb) [cm] 15x22.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 5.5/15 group Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 13.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name P north small strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10x22.5 min. size (hxb) [cm] 10x22 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 5 tangential

Knots [min d/section h] 3/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 17 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name Q north small post

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.6x20.9 min. size (hxb) [cm] 10x20.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 4 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 15.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name R north rafter

Dating original construction Signs of reuse

Timber treated ☐

Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 30.5x23 min. size (hxb) [cm] 30x23 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 6/23 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II



crack close to bottom end I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑	unknown	unknown
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☑ unknown

Measurement Point a

Moisture Content [%] 14.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

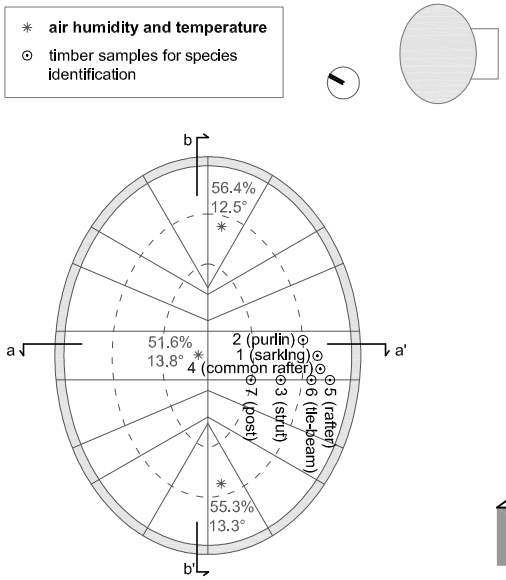
Measurement Point b

Moisture Content [%] 15 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

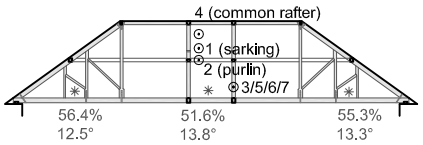
Measurement Point c

Moisture Content [%] 14.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Plan 1:500

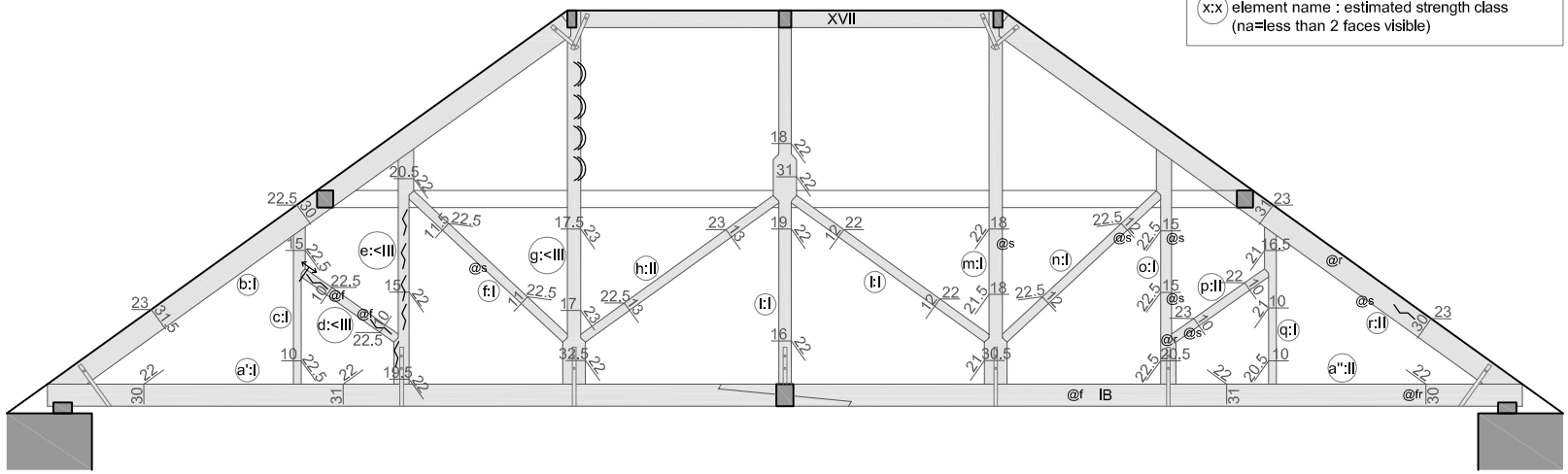


Section aa' 1:500 (looking South)

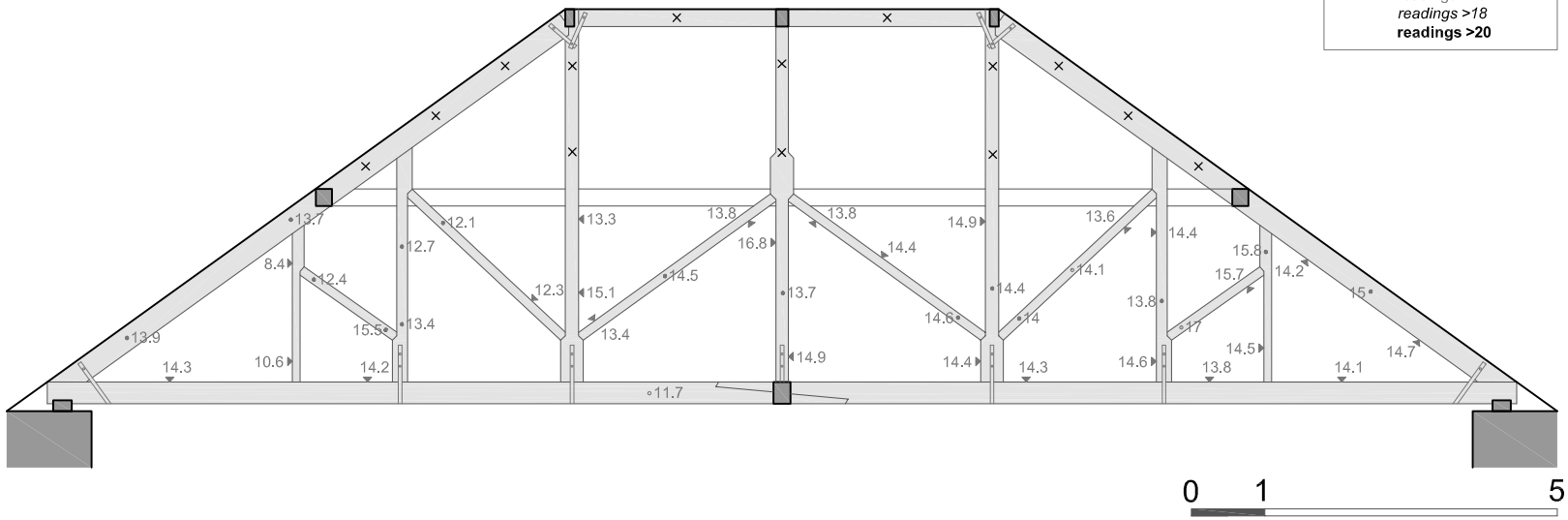


0 5 10

Section aa' 1: 100 (looking West)



Section aa' 1: 100 (looking West)



0 1 5

GLASGOW ST ANDREW'S IN THE SQUARE CHURCH

Location: GLASGOW, CITY OF | GLASGOW (GLASGOW, CITY OF)

X coordinate: 259698 Y coordinate: 664681

Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: CHURCH

Rcahms ID: 44237

HS Listing: A

Original Use: Religious

Current Use: Religious

Freestanding: ☑ N. of floors above ground level: 1 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1740	1757	ROOF STRUCTURE BUILT BETWEEN 1751 AND 1753	RENWICK 1911

People involved:

Last Name	First Name	Role	Attributed
DREGHORN	ALLAN	DESIGNER	☐
NAISMITH	MUNGO	MASON	☐
CLAYTON	THOMAS	PLASTERER	☐
ROBERTSON	JOHN	WRIGHT	☐
CROSS	JAMES	MASON	☐
LAWSON	GAVIN	MASON	☐
CATION	DAVID	MASON	☐
WILSON	JOHN	WRIGHT	☐
FLEMING	WILLIAM	WRIGHT	☐

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1874		INTERIORS	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1906			RCHAMS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1921		INTERIORS	HS

People involved:

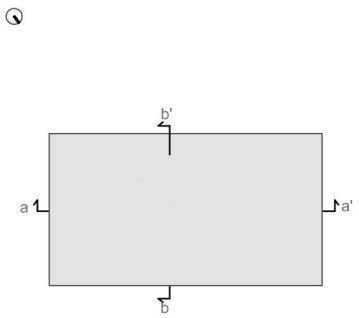
Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1980	1989	NO RECORDS - CHURCH ARCHITECT THINKS IT INVOLVED CARBON FIBRE RODS AND RESIN INJECTION BY RBR SCOTLAND LTD	CHURCH ACHITECT

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
GLENDINNING M. & MACKECHNIE A.	2004	☐	SCOTTISH ARCHITECTURE	118
RENWICK R. (ED.)	1911	☐	EXTRACTS FROM THE RECORDS OF THE BURGH OF GLASGOW WITH AND OTHER DOCUMENTS VOL. VI A.D. 1739-59	
WILLIAMSON E. & RICHES A.	1990	☐	THE BUILDINGS OF SCOTLAND COLLECTION: GLASGOW	

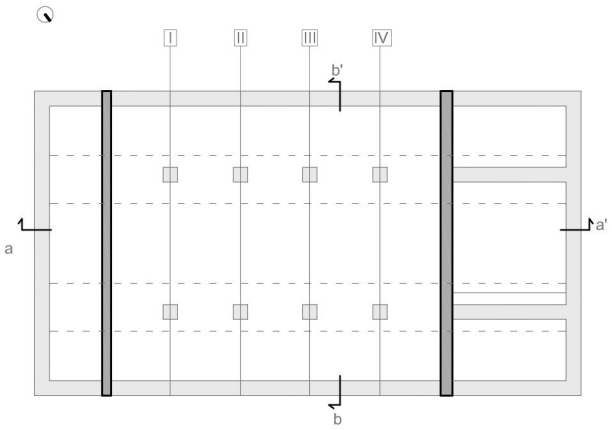
Suggestions for further research:



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

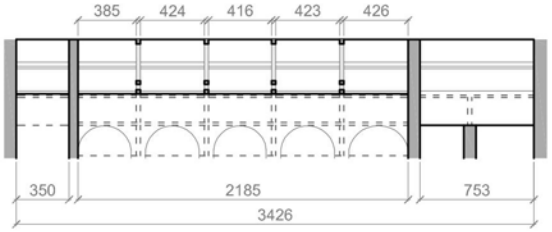
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

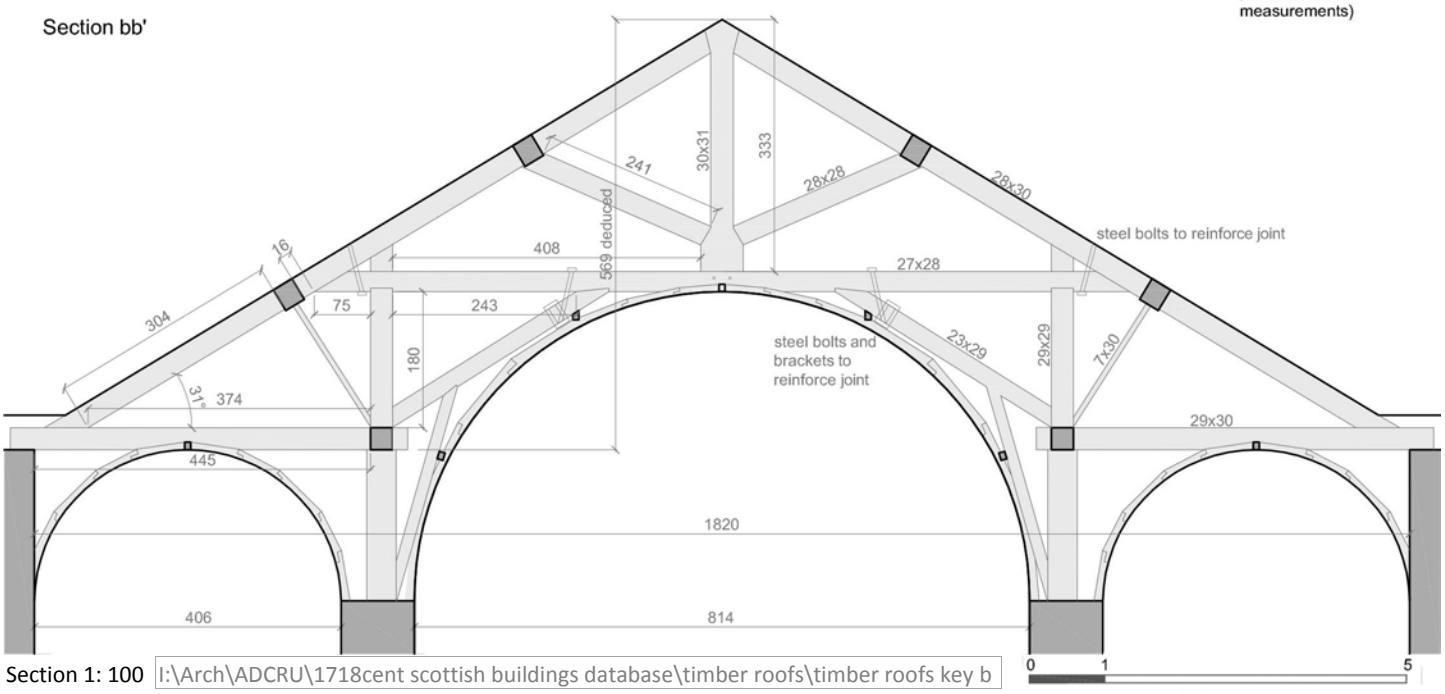
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

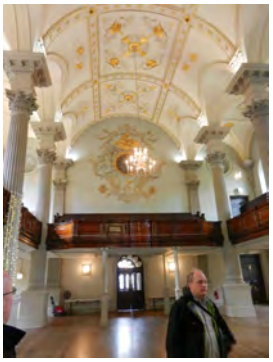
Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



Roof from outside I:\Arch\A



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** GLASGOW ST ANDREW'S IN THE SQUARE CHU | **Roof location** Church main hall

Survey date(s) 31/08/2015 | See drawing: SASC-MH-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 8.4 - 4 | Roof Height [m]: 7.7

Roof Pitch/es [°]: 31 | Roof Length [m]: 34.3

Type of Primary Structure: 2D framing

Truss ☑ PRINCESS-POST

Frame ☐

Average Distance in between Primary Structure [m]: 4.5

Type of Secondary Structure: common rafters, purlins, sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: None

Connection with gables: purlins

Roof Construction Period: From 1739 To 1756 Identified by: Estimated

Roof General Description: Gabled roof with steeple on northwest side. Steeple structure wasn't surveyed. Main roof supported by two transversal walls and 4 princess post trusses in the central part. All three posts have slanted struts on both sides. Trusses span reduced by intermediate columns, one on each side. Original plaster ceiling underneath.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular, Square

Rafter Scantling [cm] H: 30 B: 28 Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) Bark ☐

Joint Types: joggle, mortice and tenon, notch

Fasteners Types: Timber dowel

Joints description: All mortice and tenon, timber dowels only between central post and collar. Central post has joggles. Lateral post and slanted strut between lateral post and collar have notches. Fasteners not visible.

Wood Species: pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: small chiseled roman numerals, strange marks (from scandinavia?)

Carpentry Marks Description: In sequence from I to IIII (east to west)

Signs of reused timbers:

Timber Treated ☐

Other Materials: Resin and steel bolts/brackets

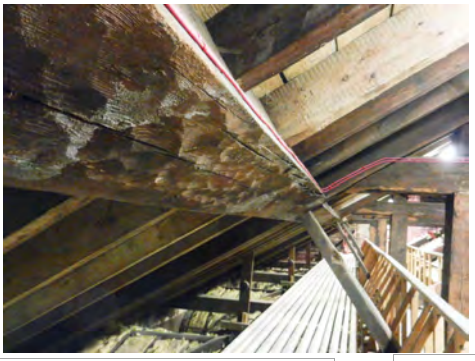
Dendrochronology:



Roof structure link I:\Arch\A



Connection with wall link I:\Arch\A



Timber dressing link I:\Arch\A



Joints and carpentry marks link I:\Arch\A



carpentry marks on sarking link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features: Original plaster vaulted ceiling underneath

Unfavourable conditions: poor ventilation

Accessibility limitations: lower part of lateral posts not visible

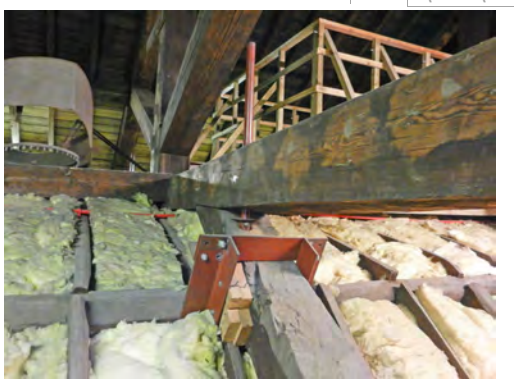
Past interventions: Some sarking and common rafters replaced. Steel bolts added to reinforce joint between rafter and collar. Steel brackets and bolts added to reinforce joint between slanted strut and collar. Checks filled with resin. Insect treatment in 1990s.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☑ Humidity stains ☑ Diffuse insect exit holes ☐

Fungi attack close to west gable wall. It's active, they are trying to treat it. Some insect attack on rafters and collar, only in corners.



Past interventions | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks	Active	
Connection Damage	Disconnection	Unknown	



Material degradation | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: purlin cracking | link | I:\Arch\A

Description of visible damage: Some elements are cracking: purlins, rafters... Some joints between posts and struts are opening. Not sure what the cause might be.



Damage: rafter cracking | link | I:\Arch\A

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber

DETAILED SURVEY **Building name** GLASGOW ST ANDREW'S IN THE SQUARE CHURCH **Roof location** Church main hall

Survey date(s) 20/01/2016 16/02/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SASC-MH-1, SASC-MH-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafter	1045	square	bending, compression	pinus sylvestris	hand axed and hand sawn
Centrtal post	330	square	compression	pinus sylvestris	hand axed and hand sawn
Upper strut	260	square	bending, compression		hand axed and hand sawn
Collar	1080	square	bending, compression	pinus sylvestris	hand axed and hand sawn
Lateral post	470	square	compression		hand axed and hand sawn
Strut post&collar	335	square	bending, compression	pinus sylvestris	hand axed and hand sawn
Strut post&rafter	190	rectangular	compression	pinus sylvestris	hand axed and hand sawn
Strut post&strut	295	rectangular	compression		
Interrupted tie-beam	525	square	bending, tension		hand axed and hand sawn
Purlin	450	square	bending, compression	pinus sylvestris	hand axed and hand sawn
Common rafter		rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
Sarking		sheet	bending, tension	pinus sylvestris	hand axed and hand sawn

* estimated based on drawings because not fully accessible

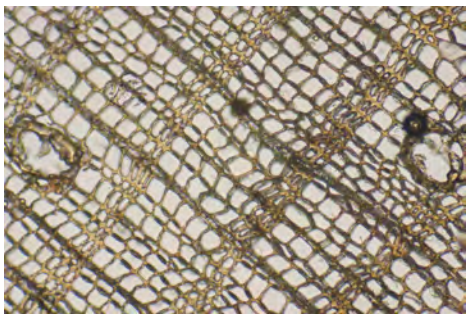
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SASC-MH-1, SASC-MH-2

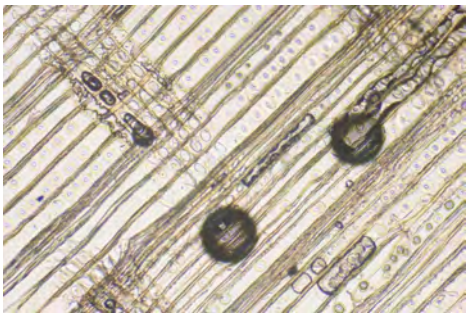
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
central post & struts/rafters	Encounter mortice & tenon with joggles	compression	none	
central post & collar	Encounter mortice & tenon	compression	wooden dowels	
strut & collar, strut & strut	Encounter birdsmouth	compression, shear	none	
all others	Encounter mortice & tenon	compression	none	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

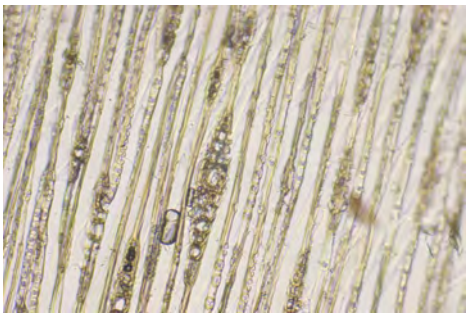
Microscopic identification of the timber species See drawing SASC-MH-2



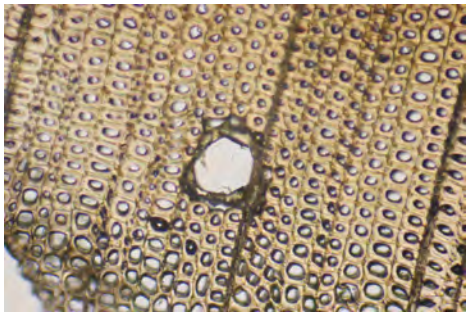
Strut: transv. section x100 I:\Arc



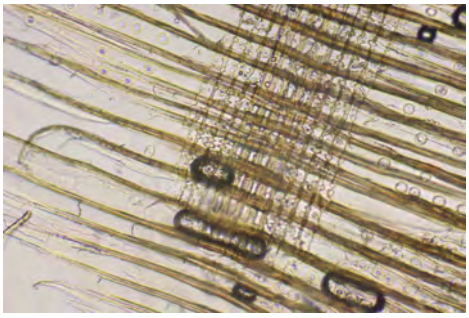
Strut: radial section x100 I:\Arc



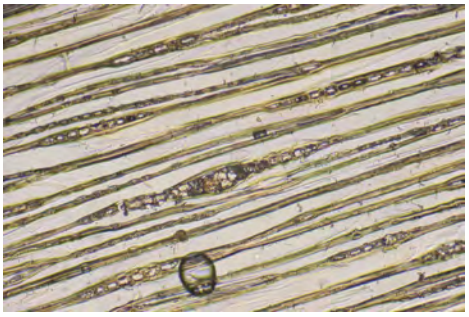
Strut: tang. section x100 I:\Arc



Purlin: transv. section x100 I:\Arc



Purlin: radial section x100 I:\Arc



Purlin: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing SASC-MH-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
attic space	E side	16/02/2016	1:20 pm	18.3	36

attic space	W side	16/02/2016	1 pm	18.5	34.5
roof space	SW side	16/02/2016	10:10	13.4	55.8
roof space	centre	16/02/2016	10:30	13.2	56.6
roof space	NE side	16/02/2016	10:50 am	13.3	56.5

Frame/Truss name III — See drawing SASC-MH-2

Missing elements:
Elements with defects in critical area: collar, N strut between post & collar
Joints with decayed peg:
Insect attack: rafters & collar
Failed joints: between collar & N rafter, between S strut & post
Fungi attack: E gable
Other: shaked at top end of S rafter - N rafter & S upper strut partly rotated

Element name A south lateral post

Dating: original construction
Signs of reuse:
Timber treated: ☑ for insects, in 1990s
Accessibilityissues: lower part not well visible
Past interventions:
Differences compared to other elements of the same type:
Section: nominal size (hxb) [cm]: 29x29.7 min. size (hxb) [cm]: 29x29.5 Single piece: ☐ Jointed element: ☑

Strength affecting defects

Pith location: centre Slope of grain [%]: 3 tangential
Knots [min d/section h]: 9/30 group Knotty element: ☑ Defects in critical area: ☐ Deep checks on both sides of element: ☐
Other defects:
Estimated Strength Class according to UNI 11119: I



lower end with treatment for insect I:\Arc

Material degradation

Insect attack: ☐ Type: Status: Way of identification:
Fungi attack: ☐ Type: Status: Way of identification:
Corrosion: ☐ Wet surface: ☐ Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: Emergency interv. needed: ☐
Mater.Degr. and Damage Extent: Way of identification:

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%]: 15.4 Visible Material Degradation: ☐ Not Accessible for: hygrometer: ☐

Measurement Point b
Moisture Content [%]: 15.7 Visible Material Degradation: ☐ Not Accessible for: hygrometer: ☐

Element name B south strut post & rafter

Dating: original construction
Signs of reuse:
Timber treated: ☐
Accessibilityissues:
Past interventions:
Differences compared to other elements of the same type:
Section: nominal size (hxb) [cm]: 8.5x30.2 min. size (hxb) [cm]: 8x30 Single piece: ☑ Jointed element: ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 6 tangential
Knots [min d/section h]: 8.5x30.5 single Knotty element: ☑ Defects in critical area: ☐ Deep checks on both sides of element: ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C south interrupted tie-beam

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues end close to wall not well visible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 29.1x30.6 min. size (hxb) [cm] 29x30.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] 2.5/31 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



joint with rafter and wall I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 15.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues bottom end close to wall not well visible

Past interventions steel reinforcement at joint with collar

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 29.3x29.7 min. size (hxb) [cm] 28x29.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 1 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects shake close to upper end

Estimated Strength Class according to UNI 11119 III



insect attack on lower corner I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status unknown

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent insect attack seems to be affecting only sapwood on corners of element

Way of identification visual inspection

Measurement Point a

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 15.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 15.3 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point e

Moisture Content [%] 13.2 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point f

Moisture Content [%] 13.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name E south strut post&collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions steel brackets reinforcing joint with collar

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 24x26 min. size (hxb) [cm] 24x26 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 7/21 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III



joint between struts I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	16.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	16.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	16.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name F collar

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1990s

Accessibilityissues

Past interventions steel reinforcement at joint with rafters

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 26.9x28.6 min. size (hxb) [cm] 25.5x27 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 13 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects highly inclined slope of grain close to joint with N rafter

Estimated Strength Class according to UNI 11119 II



reinforcement of joint with rafter I:\Arc

Material degradation

Insect attack ☑ Type Anobium Punctatum Status unknown

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a			
Moisture Content [%]	14.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	13.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	14.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	14.2	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐
Measurement Point e			
Moisture Content [%]	14.1	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐
Measurement Point f			
Moisture Content [%]	14.3	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐

Element name G south upper strut

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 28.2x27.5 min. size (hxb) [cm] 28x27 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 9 tangential
Knots [min d/section h]
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I



Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

wedge in joint with rafter I:\Arc

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a			
Moisture Content [%]	13.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			

Moisture Content [%] 13.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 13.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name H central post

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1990s Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 30x29.5 min. size (hxb) [cm] 30x29.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 4 tangential

Knots [min d/section h] 10/30 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other



treatment for insect at top end I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Measurement Point a

Moisture Content [%] 14 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 13.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name I north upper strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 27.7x27.7 min. size (hxb) [cm] 27.5x27.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	13.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	13.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	15	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name L north rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions steel reinforcement at joint with collar

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 29.2x28.1 min. size (hxb) [cm] 29x28 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 1 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☑ Type Anobium Punctatum Status unknown

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other



rotation of north rafter I:\Arc

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.6 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 15 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 14.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name M north strut post&collar

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1990s Accessibilityissues

Past interventions steel brackets reinforcing joint with collar

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 22.5x27.2 min. size (hxb) [cm] 22x26.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 11 tangential

Knots [min d/section h] 3/21 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 16 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 15.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name N north lateral post

Dating original construction Signs of reuse

Timber treated ☑ for insects, in 1990s Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 30.2x29 min. size (hxb) [cm] 30x29 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] 4/29 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 13.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name O north strut post&rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 6.7x30.2 min. size (hxb) [cm] 6.5x30 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 5.5/30 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

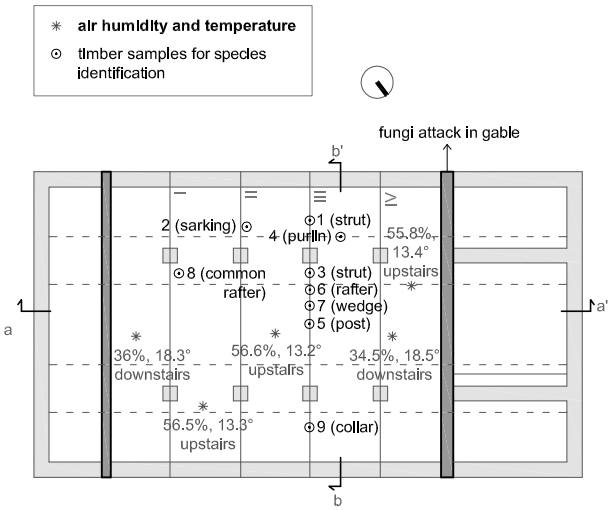
Measurement Point a

Moisture Content [%] 15.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

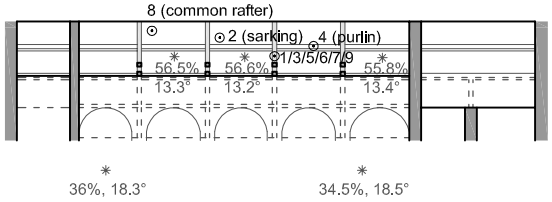
Measurement Point b

Moisture Content [%]	15.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Plan 1:500

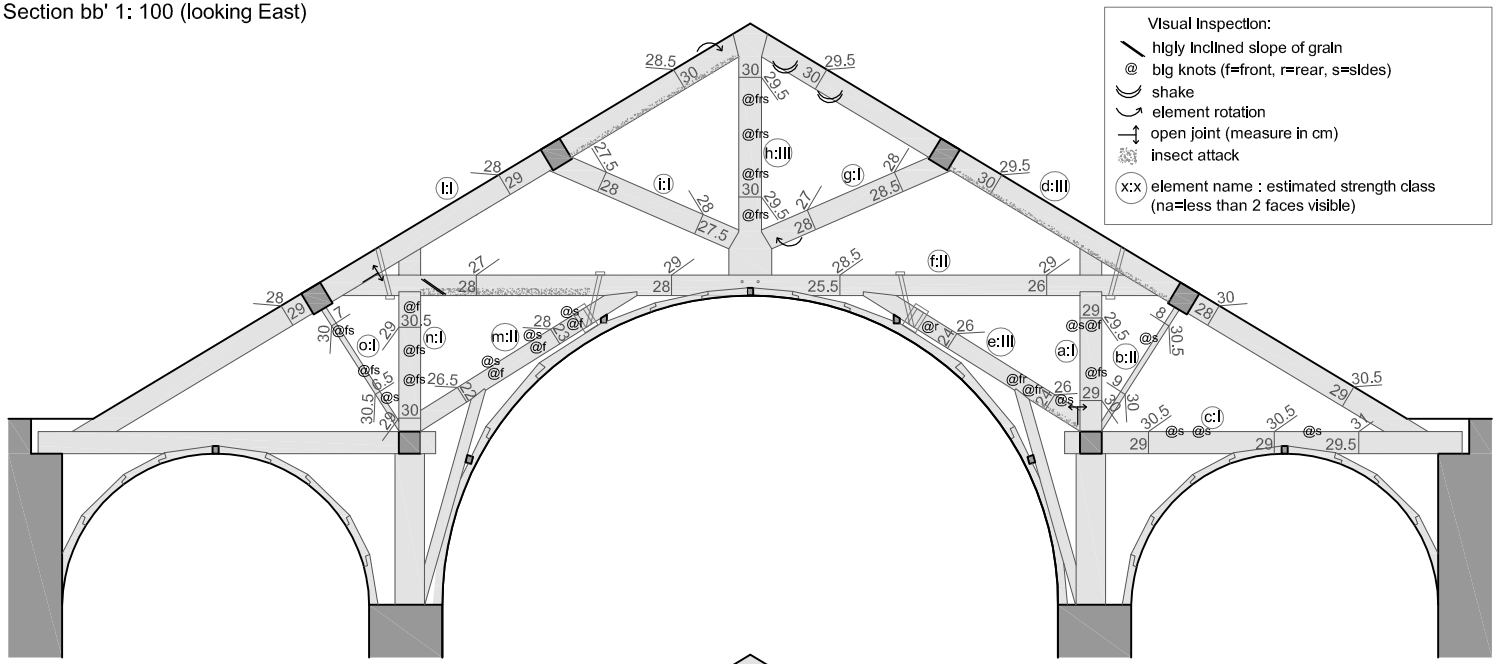


Section aa' 1:500 (looking South)

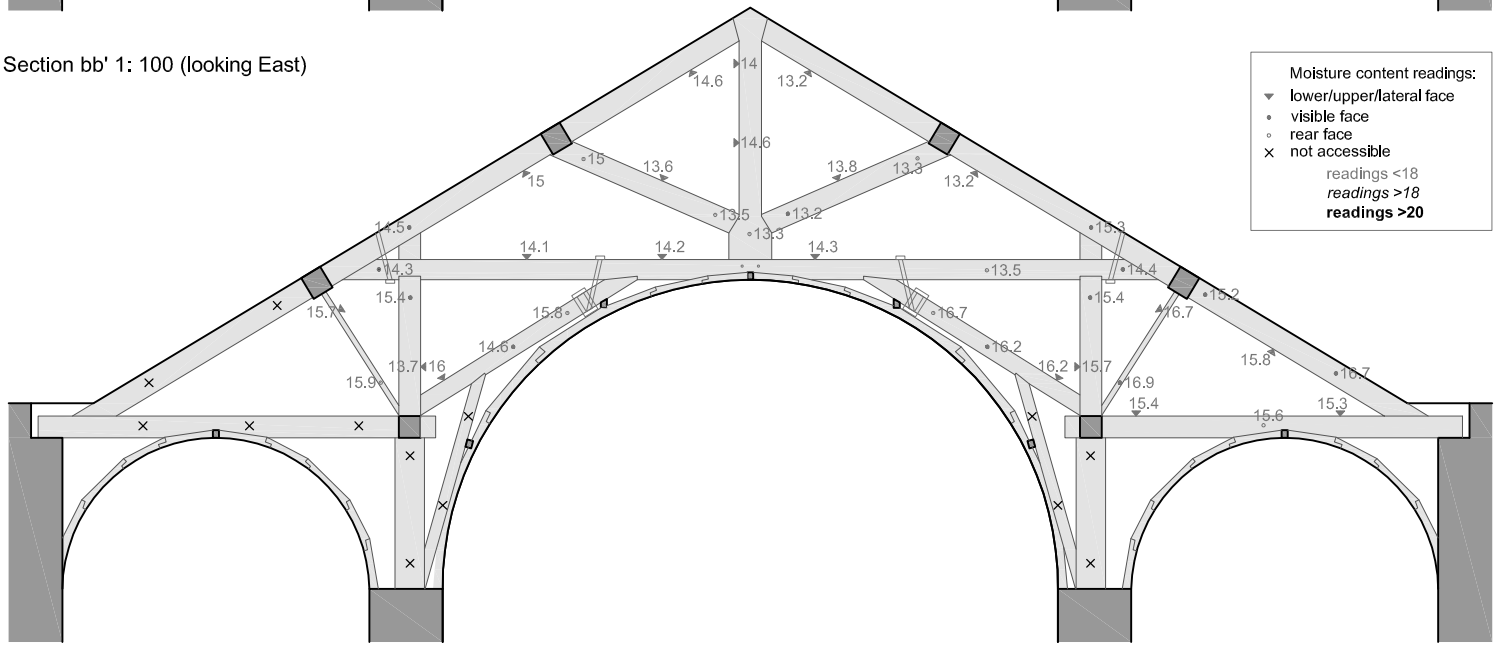


0 5 10

Section bb' 1: 100 (looking East)



Section bb' 1: 100 (looking East)



0 1 5

STIRLING CASTLE

Location	STIRLING		STIRLING
X coordinate	279000	Y coordinate	694000
Geogr. Referencing System	BRITISH NATIONAL GRID		





Property status	PUBLIC
Rcahms ID	46245
HS Listing	A
Original Use	Military, Residential
Current Use	Museum

Freestanding ☑ N. of floors above ground level 4 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1100	1199	AT LEAST, BUT COULD BE OLDER	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1370	1379	N GATE IS PROBABLY THE EARLIEST SURVIVING BUILDING	HS

People involved:

Last Name	First Name	Role
KING OF SCOTLAND	ROBERT II	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1495	1505	MAIN FRONTISPIECE OF THE CASTLE AND MAIN ROYAL ENCLAVE	HS

People involved:

Last Name	First Name	Role
KING OF SCOTLAND	JAMES IV	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1500	1799	DEFENCES OF THE NETHER BAILEY, ON A LOWER TERRACE N OF THE MAIN ENCLOSURE	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1530	1555	PALACE	HS

People involved:

Last Name	First Name	Role
KING OF SCOTLAND	JAMES V	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1550	1559	ARTILERY BASTION AND FLANKING WORKS	HS

People involved:

Last Name	First Name	Role
QUEEN OF SCOTLAND	MARY OF GUISE	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1557		KING'S OLD BUILDINGS, MAINLY 16TH CENTURY, PERHAPS 1557	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1585	1625	W RANGE OF PALACE REBUILT AND PARTS OF BOTH THE KITCHEN AND S RANGE CLEARED AWAY TO RATIONALISE THE PALACE PLAN AFTER SERIOUS STRUCTURAL COLLAPSE	RCAHMS

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1594		CHAPEL ROYAL ON THE N SIDE	HS

People involved:

Last Name	First Name	Role
KING	JAMES VI & I	COMMISSIONERPATRON

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1671	1687	REPAIRS - ROOFS AS WELL	EUL LA II 87 - NRS GD/29/92 - NRS GD124/11/37 - NRS E37/24 - NRS E36/30

People involved:

Last Name	First Name	Role
MCCLELAND		WRIGHT

MCCLELLAND	JAMES	WRIGHT
BRUCE	SIR WILLIAM	SURVEYOR GENERAL
BAINE	JAMES	MATERIAL SUPPLIER

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	1699	1703	WORKS TO THE ROOFS, INCLUDING RE-SARKING, CUTTING THE RAFTERS (COUPLES) TO INSERT WINDOWS, REINFORCING THE RAFTERS (COUPLES) WITH ADDITIONAL TIMBERS.	NRS E37/33

People involved:

Last Name	First Name	Role
SANDS	ANDREW	WRIGHT
MAN	JAMES	MATERIAL SUPPLIER, WRIGHT
ALLAN	JAMES	MATERIAL SUPPLIER, WRIGHT
LOU	JAMES	WRIGHT
WATSON	JAMES	MERCHANT

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1708	1714	OUTER DEFENCES	HS

People involved:

Last Name	First Name	Role
DURY	CAPTAIN THEODORE	DESIGNER
SMITH 1	JAMES 1	ENGINEER
BACHOP	THOMAS	MASON
WATSON	JAMES	MASON
MOWBRAY	ROBERT	WRIGHT
SMITH	GILBERT	MASON

Intervention type:	From:	To:	Description:	Reference:
RECONSTRUCTION	1855		NORTH AND EAST WINGS OF KING'S OLD BUILDINGS REBUILT AFTER FIRE	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1975	1976	RENOVATION OF INTERIORS OF KING'S OLD BUILDINGS	HS

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
CRONE A. & FAWCETT R.	1998	☐	DENDROCHRONOLOGY, DOCUMENTS AND THE TIMBER TRADE: NEW FOR THE BUILDING HISTORY OF STIRLING CASTLE, SCOTLAND	
FENWICH H.	1970	☐	ARCHITECT ROYAL. THE LIFE AND WORKS OF SIR WILLIAM BRUCE, 16	39, 73, 90
GIFFORD J.	2002	☐	THE BUILDINGS OF SCOTLAND COLLECTION: STIRLING AND CENTRAL	
GOMME A.	2002	☐	SCOTTISH HAMMERBEAM ROOFS AND ONE THAT ISN'T	
HANKE T.	2007	☑	ASPECTS OF TIMBER IN RENAISSANCE AND POST-RENAISSANCE SCO THE CASE OF STIRLING PALACE	
TABRAHAM C. & GROVE D.	1995	☐	FORTRESS SCOTLAND AND THE JACOBITES	25-32, 46-51

ARCHIVAL REFERENCES

Archive	Doc.Num.	Folios
National Records of Scotland	E36/30	

Title: Sir William Bruce of Balcoskie: Holyrood, Stirling, Edinburgh, the Bass, 4 Mar. 1671-18 Jan. 1674, rendered 9 July 1674

Archive	Doc.Num.	Folios
Edinburgh University Library	La II 87	1A

Title: Holyroodhouse, Stirling Castle, Dumbarton Castle, Edinburgh Castle Vouchers of expenditures on works (1684-86)

Archive	Doc.Num.	Folios
Edinburgh University Library	La II 87	6

Title: Wright work at Holyroodhouse and Stirling Castle (4 vouchers)

Archive	Doc.Num.	Folios
National Records of Scotland	GD124/15	471

Title: Letter to the Earl of Mar from Mr James Smith, surveyor of Her Majesty's works, in Edinburgh. He describes the dismal state of the

Palace of Holyroodhouse and the Castle of Stirling.

Archive	National Records of Scotland	Doc.Num.	GD124/11	Folios	37
Title	Letter to the Earl of Mar from the Privy Council, authorising him to repair roof etc of Stirling Castle				
Archive	National Records of Scotland	Doc.Num.	E37/24	Folios	
Title	Estimate of materials required for reparation of Holyroodhouse, with notes of unfinished rooms their work to be done by Robert Mill under contract and of buildings and repairs necessary at Stirling Castle				
Archive	National Records of Scotland	Doc.Num.	GD29/92	Folios	
Title	Warrant by the Lords Commissioners of the Treasury to Sir W. Bruce of Balcaskie as Surveyor General to repair the roof and alleyways at Sterling Castle, provide for wright and glass-work of the rooms there				
Archive	National Records of Scotland	Doc.Num.	E37/33	Folios	
Title	Duplicate account of work in Stirling Castle, bearing copy treasury warrant discharging Earl of Mar for sums required - Sep 1699-July 1703				
Archive	National Records of Scotland	Doc.Num.	GD124/15	Folios	207/3
Title	Letter to the Earl of Mar from the Earl of Seafield. Difficulty in obtaining money to repair Stirling Castle - 9 Apr 1700				
Archive	National Records of Scotland	Doc.Num.	GD124/15	Folios	216/2
Title	Letter to the Earl of Mar from the Marquis of Annandale. Annandale has urged the Lords of Treasury to do something for the Castle of Stirling - 11 Apr [1701])				
Archive	National Records of Scotland	Doc.Num.	GD124/15	Folios	506/23
Title	Letter to the Earl of Mar from the Earl of Glasgow. Sensible of Mar's diligence in the above matter. Payment made for repair of Stirling Castle - 19 Jun 1707				
Archive	National Records of Scotland	Doc.Num.	GD124/15	Folios	567
Title	Letter to the Earl of Mar from Col John Erskine, his step-father, at Alloa. Family matters. Negotiations with Balgowan. Repairs to Stirling Castle necessary - 16 May 1707				
Archive	National Library of Scotland	Doc.Num.	MS1646Z02	Folios	18a
Title	Plan of the 3d Stage at A in the Section, Andrews Jelfe (Architect), Thomas Moore (Engineer)				

Suggestions for further research	Maybe Stirling Town Archives

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive National Records of Scotland Doc. Num. GD29/92 Folios

Title: Warrant by the Lords Commissioners of the Treasury to Sir W. Bruce of Balcaskie as Surveyor General to repair the roof and alleyways at Sterling Castle, provide for wright and glass-work of the rooms there — Date: from 1671 to

Contents:
1671
remove iron gratings from the windows *in the front of the house* [holyrood]
[...] with all possible diligence he make effectuall and speedie? provision of stone, lime, timber, iron, glass & all other necessarie for that work in the most frugall way and to the best advantage he can: he observing in all his ma.ties directions and orders of worke [...] he is also appointed to repair the roofs and alleways of Stigling Castle, making them *wind-tight*
He needs to make the carriage for the cannon and the dyke in the park too. He shall provide materials and workmanship for all the works.

Summary and comments: 1671 Sir William Bruce, the King's Surveyor General, is appointed to repair the roofs of Stirling Castle and make them wind-tight. No details of the works.

Archive National Records of Scotland Doc. Num. E36/30 Folios

Title: Sir William Bruce of Balcoskie: Holyrood, Stirling, Edinburgh, the Bass, 4 Mar. 1671-18 Jan. 1674, rendered 9 July 1674 — Date: from 1671 to

Contents:
Hollyrudehouse 7th Septr 1671
Discharge
Repayed to James Bayne £480 payd out by him for 1000 daill bought from Jon Neilson merd in Stirling for the use of the reparationes at Stirling Castle conforme to receit n.1 £480
Jon Anderson & William Patton skippers in Leith for transporting the timber in their boat up to the Castle
Jon Hamilton overseer of works
knappel, stones, lime, wainscot, hair, nails, sand, ...
Samuel Mckreef for knappel wainscot & other timber £621 15s.

Summary and comments: 1671 wright James Baine is paid for 1000 deals for the repair works at Stirling Castle. Another merchant is paid more than £600 for other timber.

Archive National Records of Scotland Doc. Num. E37/24 Folios

Title: Estimate of materials required for reparation of Holyroodhouse, with notes of unfinished rooms their work to be done by Robert Mill under contract and of buildings and repairs necessary at Stirling Castle — Date: from 1682 to

Contents:
[outside] *Estimat of materialls to be provyded for the use and towards the reparation of his Ma.ties Palace of Holyroodhouse As also ane nott of such roumis as ar yet unfinished in the said Palace. Lykwayis A Particular nott of Buildings & Reparationis necessar at his Ma.tis Castle of Stirling*
18th July 1682
[inside] *Estimat of materialls to be provyded for the use, and towards the reparation of his Ma.ties Palace of Holyroodhouse, to be presently done, as follows viz*
lime for mason work & plaster in Duke of Hamilton and Treasurer and Lord Registers apartments
sand
rebats to make two arches in the Duke of Hamilton kitchen and a door in the Treasurer's apartment
stone plaster hair
door nails
[...] *whytning or spanish whyt?* [...] *for whytning of rooffs &syd? walls which stand in wood*
[...] *1000 dailla* [...] *towards these reparations for sarking below the leaid work within the ??? Palace 48£ per 100* £480
[...] *half hundred double treis for the rofe of the work 18p. peece* tot. 54£
[...] *100 single trees at 9s. peece* £45
[...] *20 great trees for sawing at 2£ 10s. peece* £30
[...] *knappill for making new casem.ts*
[...] *5000 double floorings* [...] *for the rofe of the work at 10£ 1000* £50
single flooring
blind flooring
planshers
windows
[...] *1000 stones of lead [...] for helping of the main rooff & the infys of the wallheads & outfys of the ??? Palace*
[...] *half hundred great trees needful for making of garrons to lay upon the wallheads of the lead* [...] *at 1£ 10s. peece* £90
[...] *30 oak planks needful for going along the fare of the cornice whereupon the lead is to be layid at 1£ 10s. peece* £45
[...] *6000 scailie naills needful for putting on the slaits, that must be taken off the easing? in the infys of the Palace to get the lead*
[...] *layid in bilowit? at 5£ 1000* £30

[...] *100 prick? batts for putting on of the oak planks which project above the fare of the cornice at 4£ p.* £20
[...] *hogsheads of trass or pan cratch for pointing the alloring upon the wallheads & round the old tower?*
window nails
A particular nott of such roumes in the Palace of Holyroodhouse & others that are not yet finished nor completed viz.
[...] the rooff and the walls of the Pratches? from the great stairs to the door of the entrie of the Duke of Hamiltons lodgings is not yet plaistered
mason work that Robert Mill didn't do yet
A particular nott of Buildings & Reparations necissar at his Ma.tis Castle of Stirling as followes
[...] *Item the gallery or Transe w.ch enters the great hall being ane hundred feet long & thirten feet wyde wants the rooff and must be sarked and slated.*
[...] *Item the slait rooff of this Palace must be pointed & helped in severall of the flankers, or run rooff, as lykways the Bartisan covered with lead, together with the slait rooff and Bartisan of the great hall.*
Item the one side of the slait rooff of the Chappill became ruinous this last winter, and must newly sarked with dailles and newly slaites on that side; wheter the rooff y.rof be faulty or not cannot be known till the slaits & old sarken be taken off.
[...] *the slait rooffs of the whole castle would be pointed and a bargan made with a slaiter to maintain ym. yearlie hereafter upon a rentan yearly pension or sallarie.*
[...] *It is necessar all this work above mentioned be presently gone about* [...] *and for this effort it is necessar that money be provided for buying of materialls & payment of workmen* [...]
As to the particular Estimat, what these buildings and Reparations will cost at Stirling Castle it cannot be exactly sett doune without measuring of the dimensions of the places & rooffs to be built and repaired, w.ch must be done upon the place. [....

Summary and comments: 1682 materials needed to repair Stirling Castle: the gallery or transe which enters the great hall needs all the roof done; the chapel needs to be resarked and reslated and maybe even structural repairs, based on what is found once the sarking is taken off; the rest of the roofs need pointing and a slater should be contracted for their maintenance.

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 6

Title: Wright work at Holyroodhouse and Stirling Castle (4 vouchers) | Date: from 1684 to 1686

Contents
1
[outside] *Accompt of wright work at the Palace of Holyroodhouse 1685 be James Mcleland £ Scots 1144 14s.*
[inside] [...] *December 1684 to Jully 1685*
Frames for paintings, windows, casements, new coach house, repairs to guard stables, tables, benches, beds, shelves, press, partitions, doors, ladders, ...
TOT £1144 15s. 8d.
2
[outside] *Accompt of wright work at Stirling Castle 1685 be James Mcland Scots £655 16s. 06d.*
[inside] *Accompt of wright work wroght at the Castle of Stirling Be James Mcleland frae 29 of May to 24 of September 1685 conforme to agreeement*
Lining floors and windows and walls, making shelves, barrowes, ladders, tresses, boxes, casements, garrones, partitions, doors, ...
For making & ane putting ane new roof on the maine gaird ??? of 27 couple & sarking of the??? £48 12s.
TOT £655 16s. 06d.
3
[outside] *Accompt of wright work BeJames Mcleland at the Palace of Holyroodhouse fra Jyllu 1685 to March 1686*
Scots £1031 2s.
[inside] lining, flooring, casements, tables, presses, doors, shelves, windows, stairs, partitions, beds, replacing roof of stables and other repairs, ...
4
[outside] *Receipt Jon Hamiltone wright to Mr Jas Smith £6 7s, 5d. for reparatione in the foot guard. Hollyrudhous Scots £76 9s.*
6
[outside] *Instructions for the 8 article by the Abbreviat Acct.*
James McClealand and accompt for wright worke done at stirling and the abay
£2879 10s. 6d.
[outside] *Abbreviat accompt of wright worke by James McCleland wright for worke done at the palace of Holyroodhouse and Castle of Stirling from december 1684 to march 1686*
Frames for paintings, High Commissioner accommodation, girnels, platforms, repairs at stables, benches, ...
TOT £2908 10s. 6d.

Summary and comments: nothing related to roof structures

Archive: Edinburgh University Library | Doc. Num.: La II 87 | Folios: 1A

Title: Holyroodhouse, Stirling Castle, Dumbarton Castle, Edinburgh Castle Vouchers of expenditures on works (1684-86) | Date: from 1684 to 1686

Contents
[outside] Missing part
Mr James Smith
By
An accompt of money payed to severall persons for work & materialls furnished for the use of his Maj Palace & Castles from 14 Aprile 1684 to 1 of March 1686
[inside] *By an accompt of money payed to Mr James Smith overseer to his Mties works, and to his orders by Hugh Wallace of Inglistoun his Majesties cashkeeper from 14 Aprile 1684 to 1 March 1686*
1. Clearing casway-layers and others in Edinburgh Castle £360

2. Not specified £7704 4s.
3. To pay workers £4093 11s. 10d.
4. Not specified £657 15s.

TOT £12814 10s. 10d.

Received by J. Smith

By an accompt of money debursed by Mr James Smith overseer to his Mties works to the particular persons after mentioned for work don and wrought by them at his Maties Palace and Castles conform to the particular instructions afterspecified from 14 Aprile 1684 to March 1 1686

1. Casway men, levellers, sandmen, workmen and others to carry sand and stones and levelling the ground at Edinburgh Castle £1481 9s.
2. *It. to several persons for workmanship and furniture in repairing the Palace of Holyroodhouse for the reception of his royal highnes* […] *and afterwards continued for his Grace the Duke of Queensbury* […] *his accommodation anno 1685* […] £1002 18s.
3. Other people for works at Holyrood £1060
4. James Alexander and Mr Kikeus for painting at Holyrood and Edinburgh Castle £705
5. *To Robert Marshall wright in Dumbarton and others at Stirling* for defenses £720 18s.
6. *To James Mccleland & John Hamilton wrights for work don at the Palace of Holyroodhous & Castle of Stirling as the accompts & recepts from Dec. 1684 to March 1686* […] £ 2908 10s.
7. To James Dunbar merchant for deals and trees and two carvers brought from London to carve his Majestys statue in marble to be set up in the middle of the court of Holyrood £ 2321 16s.
8. To James Baine wright and John Callander smith for work at the Councill Chamber and windows of the privy chamber & oratory at Holyrood £629
9. Alexander Chambers for clensing walls at Edinburgh Castle £97

James Smith for visits to Blacknes, Dumbarton, Stirling Castles and the Bass £120

10. *To severall persons who were active in smothering & suppressing the fire in his Ma. Palace of Holyrood hous Feb. 1686* […] £173 4s. 4d.
11. John Mastertoun glass work at Holyrood and Edinburgh Castle 1683-4-5-6 £1130 14s.
12. *To severall persons for reparations don at his Ma. Palace of Holyroodhous in the latter end of 1685 and beginning of 1686 about the stables and other office houses* […] £463

TOT £12814 10s. 10d.

Summary and comments: Abstract of specific accounts of James Smith surveyor general between 1684 and 1686 at Edinburgh Castle, Dumbarton Castle, Stirling Castle, Holyrood Palace. Non specified works are carried out at Stirling Castle by wrights James Mccleland and John Hamilton.

Archive: National Records of Scotland | Doc. Num.: GD124/11 | Folios: 37

Title: Letter to the Earl of Mar from the Privy Council, authorising him to repair roof etc of Stirling Castle | Date: from 1687 to

Contents:

Lettir from Lords ??? Tweeddale Hamilton Atholl & Tarbats to Earl of Mar anent reparation of roof of stirling castle
12 August 1687
My Lord
having receaved information, that the ??? & ??? rooffe of his Ma.tie Castle of Stirling, was in a very bad condition, wee gave order for visiting thereof, and report being made to us of the same, wee find the condition of it is such, that if not tymengly helped, it will become altogither ruinous, and that the espense of the advance of 700 merks will prevent it; wee have therefore thought fitting, to give you Lord the trouble to cause? agree with workmen, for going presently, about the separation thereof, and that you Lord may advance the 700 merks or materialls & workmanship which shall be allowed in what you are to the King, an accompt of the by gone few dueties of the Lord or otherways. This is recommended to you […]

Summary and comments: 1687 the Earl of Mar is recommended to carry out £700 worth works to repair the roofs of Stirling Castle –this money wouldn't have been sufficient to replace all of the roofs, including the structures, but one or two yes, or the sarking for all of them.

Archive: National Records of Scotland | Doc. Num.: E37/33 | Folios:

Title: Duplicate account of work in Stirling Castle, bearing copy treasury warrant discharging Earl of Mar for sums required - Sep 1699-July 1703 | Date: from 1699 to 1703

Contents:

[outside] *Accompt of work in Stirling Castle from September 1699*
[inside] *Accompt of work by Andrew Sands wright in September 1699*
10 days and a half work with his son - brehouse, guns carriage, interiors, ...
Accompt of work wrought in the Castle of Stirling by James Man wright since the 30 October 1699 to the 28 March 1701
partition walls, doors, windows, scaffolding, floors, stairs, beds, stuff for masons/plasterers/slaters/plumbers/glaziers, ladders, models for cornices, 'happer' to feed the pigeons!...
[...] *Item for taking down the runrooff and flankers and timbering of it new over again with new sarking £9*
[...] *Item for bridleing? of the couples and cutting of safe lintles above the entry £3*
[...] *Item for cutting and bridleing? of the couples above the window that looks out in the southside of the dining room £3*
[...] *Item for cutting the rooff above the door in the Traunce? next the dining room propeing it and cutting safe lintels ??? 13d. 4s.*
Item for cutting the sarking and rooff for the limb? in the Traunce? 12s.
[...] *Item for timbering of the rooff in the long Traunce? about the chimneys and sarking it £1 1d.*
Item for cutting and takeing down of a great dormerun? in the Traunce? & cutting the couples and pulling up of another one £2
[...] *Item for cutting of the coupled and sarking for the meassons to put up the limb? in the gable behind the bed chamber and dining room £1 6s. 8d.*

Item for timbering of the limb again & sarking of it £1 4s.
[...] *Item for turning? coupleing, cutting of the couples and sarking of the windows, ther ebeing seven of them £30*
Item to ditto Mans for for mending the work £12
Item for work in the northside of the place £20
deals used also as soles of windows and doors, as 'washing boards', as floor boards
tot £704 1s. 6d. !

Accompt of work wrought in the Castle of Stirling by Tho. Bachop meason
tot £1104 2s. 8d. !

Accompt of iron work wrought to the Castle of Stirling by John Bell Smith
tot £200 6s. 8d.

Accompt of work wrought in The Castle of Stirling by Adam Jack slatter
tot £341 3s.

Accompt of glasswork wrought in the Castle of Stirling by John Don glazier
tot £367 14s. 6d.

Accompt of plaster work wrought in the Castle of Stirling by Rob. Whyt plaisterer
tot £235 16s.

Accompt of timber & other materialls furnished to the ??? work in the Castle of Stirling by James Watsons merch in Stirling from the 30th of October 1699 to the 28th March 1701
deals
deals broad
deals broad and long
single trees
double trees
great trees
great dormonds?
oak spars
wainscot planks
knaple
greta oak tree for the ???
tot £1499 3s. 10d.

Accompt of materialls furnished by James Man wright
glew = glue?
nails
garrow nails
coal and candle for him during the work
carriage of timber to the castle
windows
tot £257 9s.

Accompt of materialls to Thomas Bachop
tot £14 4s.

Accompt of materialls to Robert Whyt
tot £269 18s.

Accompt of materialls to Adam Jack
tot £108 8s.

Accompt payd to James Dick gunner
tot £2

Accompt of mony payed for the necessares under??? to the Castle by James Walsone
tot £100 1s. 6d.

TOT £5252 15s. 8d.

Accompt of work wrought in the castle of Sterling since the clearing of accompts the 26th Aptile 1701
Accompt James Allan wright
door, floor, window, ...
tot £23 7s. 6d.

Thomas Bachop mason £20 11s. 8d.
John Bekll smith £14 2s.
Adam Jack slater £61 2s.

John Don glazier £27 3s.
James Tuccoll? painter £130
Andrew Millar coupar £3 7s.
James Lou wright £4 10s.
James Watsone £624 2s. 8d.

TOT £908 5s. 10d.

Accompt of work wrought in the Castle of Stelring be James Allan wright begun in Decer 1702 and ended in July 1703
doors, stuff for masons, scaffolding, cutting 'couples' and putting 'safe lintels' for windows', floors, 'timbering the rooff'?, partition walls, shelves, seats, chimneys, cases, ...
[...] *Item for fixing trees to the cupples above the bed chamber and closet for strengthening yrof where the chamb was £6*
[...] *Item for taking off the old sarking above that part betwyxt the bed chamber & wester roum & helping the cupples and sarking of new £5*
[...] *Item for taking off the old sarking of the part* [wester chamber] *& sarking it again £2 8s.*
[...] *Item for fixing of trees for strengthening the cupples above the middle chamber & closet next the wester chamber £2*
[...] *Item for working and fixing up trees to the cupples & blaks? above these rommes £2 8s.*
[...] *Item for taking the old rotten sarking off all that part of the house* [south side] *timbering about the new limb and the plankers thereof and serving the slaters with scaffolding, planker boards and fillets £8 13s. 4d.*
tot £722 9s. 4d.

Thomas and Tobias Bachop masons £725 18s.
John Bell smith £73 14s. 10d.
Dunca Ker smith £14 13s. 8d.
Adam Jack slater £167 13s.
John Don glazier £362 13s.
Robert Whyte plasterer £90 18s.

Accompt of timber and other materialls furnished to the forsd works in the castle of Stelring By James Watsone merchand in Sterling From December 1702 to the sepoth of July 1703
deals
snades? deals
single trees
double trees
balks
long trees
short trees
wainscot
knaple
tot £1406 10s.

Accompt of materialls furnished to James Allan wright
gleu
nails
garron nails
coal and candle
carriage of timber
flooring nails
tot £300 3s. 6d.

materials to Adam Jack slater £158 2s.

TOT £10531 15s. 10d.

Charge of money got by the Earle of Mar from the Treasury? for reparations in the castle of Sterling
tot £5652 2s. 8d.

The treasury gives £10771 15s. 7d. to the Earl of Mar for these works

Summary and comments: 1699-1703 wrights Andrew Sands, James Man, James Allan, James Lou for work and merchant James Watson and wrights James Man and James Allan for materials. Works to the roofs, including re-sarking, cutting the rafters (couples) to insert windows, reinforcing the rafters (couples) with additional timbers. No roof replaced fully though.

Archive: National Records of Scotland | Doc. Num.: GD124/15 | Folios: 207/3

Title: Letter to the Earl of Mar from the Earl of Seafield. Difficulty in obtaining money to repair Stirling Castle - 9 Apr 1700 | Date: from 1700 to

Contents:
[outside] *E. Seafield 9th ap. 1700*
[inside] *Whitehall Qprile 9th 1700*
My Lord

I have obtained that letter which you desired for repairing of Stirling Castle, I have not mentioned in it the Master of the work, but however I believe it is his Office to manadge all money that is laid out upon the Kings houses & Castles, and he would take it very ill, if I should mcroach? upon him in the end of dayes, ther was much more difficulty in obtaining this letter now then there would have been at another time, because ther are so maney things to do wt the little money that we have in Scotland.
We hope now shortly to be with Yor Lord, however we have as yet sett no day for parting from this, so if you please you may ??? continue to writ what you hear, and think necessary to be known & if in any thing I can be further serviceable you may acquaint me for ther is non wishes Yor Lord better then the who am yor Lord most faithful & most humble servant Seafield

Summary and comments: No details of works.

Archive: National Records of Scotland | Doc. Num.: GD124/15 | Folios: 216/2

Title: Letter to the Earl of Mar from the Marquis of Annandale. Annandale has urged the Lords of Treasury to do something for the Castle of Stirling - 11 Apr [1701])

Date: from 1701 to

Contents:
[outside] *Marqs of Annandale 1st Aprile*
[inside] *The first of Aprile*
My dear lord I have urged the lords off Thresaurie as much as was possible for me to doe something in presence? of the Kings Letter for the Castle off Stirline the ??? Deputt after his ordinarie manner ??? ??? and ??? doe nothing at this tyme ??? who thinks he cannot doe ??? ??? he follow his leader was ??? willfull ??? ??? ??? we cleare yett there was nothing to be done nott being a quorum. I hope my dear lord you trust me I did my best as I shall ever in all your ???. ….

Summary and comments: No details of works.

Archive: National Records of Scotland | Doc. Num.: GD124/15 | Folios: 567

Title: Letter to the Earl of Mar from Col John Erskine, his step-father, at Alloa. Family matters. Negotiations with Balgowan. Repairs to Stirling Castle necessary - 16 May 1707

Date: from 1707 to

Contents:
[outside] *Coll. Erskine May 18th 1707*
Balgones affair
The north to be quitted on ???
hopes of getting payd of 300£ precept for reparation of the Castle
danger of the rooff of the great Hall & Chappel
coal sells fast at 7£ 6d. Chalder
?????????????
[inside] [...] *I request to get payment of your preceptfor the 3 hundred pound for the reparation of the Castle from time this month to be pelased to let me take your orders about it. I have ??? provyd dealls, the rooff of the great hall and the chaple will be ruined this winter if they be not mended this summer, they are good roofes and I grant pity they should fall, I wish ther wer som thing don about them. as for what furder about the garrison I doubt not but your lord will be myndfull of it and as for my own particular concern I like it wholy to you and shall truble your lord no furder now ...*

Summary and comments: 1707 Colonel John Erskine says that the roofs of the Chapel and Great Hall are in bad condition and need to be repaired soon.

Archive: National Records of Scotland | Doc. Num.: GD124/15 | Folios: 506/23

Title: Letter to the Earl of Mar from the Earl of Glasgow. Sensible of Mar's diligence in the above matter. Payment made for repair of Stirling Castle - 19 Jun 1707

Date: from 1707 to

Contents:
[outside] *E. of Glasgow Jun 19th 1707*
[inside] *My Dear Lord*
I received your last?, with a verry full & distinct accompt of your ??? dilligence, and the paine you have taken in that affair off Wightmans and Mathies; not only these two? lot? all our merchants in their part of Britain are most sensible of your ??? care of them; I shall be glad to have your ??? return as to the subsistance off our troupes; I ever am in great truth and with the greatest respect, ...
[After signature] *My Dear Lord, I took care last week to see that the 300£ for repairing Stirling Castle was payed; my mistake of our sufficient? clerks, the precet was drawen on the fonds of the civill? list, but I altered it on the army fonds, & saw payment made. aAdieu*

Summary and comments: No details of works.

Archive: National Records of Scotland | Doc. Num.: GD124/15 | Folios: 471

Title: Letter to the Earl of Mar from Mr James Smith, surveyor of Her Majesty's works, in Edinburgh. He describes the dismal state of the Palace of Holyroodhouse and the Castle of Stirling.

Date: from 1707 to

Contents:
Mr Ja. Smith concerning the Abie of Halarudhouse & Stirling Castle
Novemb. 6 1707
My Lord
since I have been preferred to be surveyor of Her Ma.tis works, I ame bound in duty to informe that unless some serious settled measure be laide doune for keeping her Ma.tis palace castles and forts in repaire they'l infallibly go all to ruine.
My lord the palace of holyroodhouse is in so dismail a conditione both in the roof & windowes that I ame ashamed to write of it, but ther is ane absolute necessitie of keeping it in repaire otherways it will inevitably perish if 500£ be bestoned by the housekeeper as I shall advise and the bond? made sune? it may be? more than a thousand pounds laide out in the ordinaire maner. What I say of the palace of holyrodhouse I may say meane? the same of the castle of stirling with the additione that the platforms and embrasures are all ruined the half being all ??? doune with the flashes of ??? and the other rotten having been made only of firr wals many years agoe but I ??? not head farr. I ought to medle? in this affaire, it being properly I being properly

the Mr of Ordonance his post to judge of and ordar these things and if any thing ??? a ??? of artiglarie be kept in thy place (of which I doubt) the master of the ordnance may order me or ??? of ane under him to represent the thing for there is ane absolute necessitie of looking after ??? in all the branches both in ??? Castle ??? Stirling as for ??? ??? not but Major Grall Maitland has given informatione since his affairs ??? ane but in a maner a doing wants greate support.
My lord wherin I am short or out of the ??? I hope will be pardoned when it is considered of preceeeding from My Lo
your most obliged dutifull most humble servt Smith

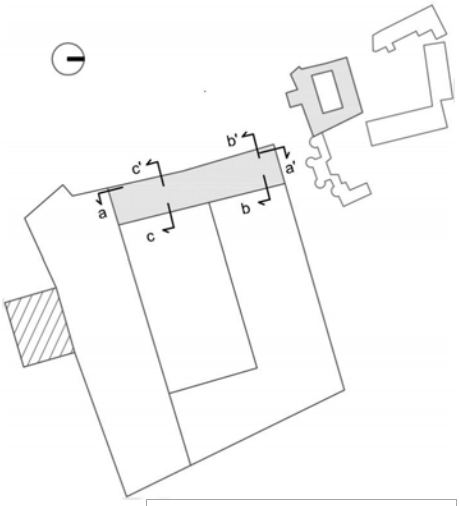
Summary and comments: 1707 James Smith, the King's Surveyor General, says that the roof of Holyrood Palace and Stirling Castle are in bad conditions – it is not sure if his evaluation is limited to the slates and sarking or includes the structure as well.

Archive: National Library of Scotland | Doc. Num.: MS1646Z02 | Folios: 18a

Title: Plan of the 3d Stage at A in the Section, Andrews Jelfe (Architect), Thomas Moore (Engineer) | Date: from 1719 to

Contents:

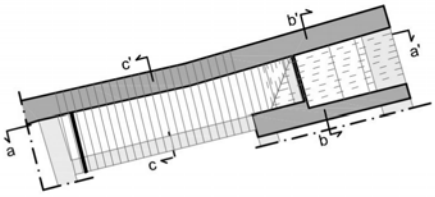
Summary and comments:



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

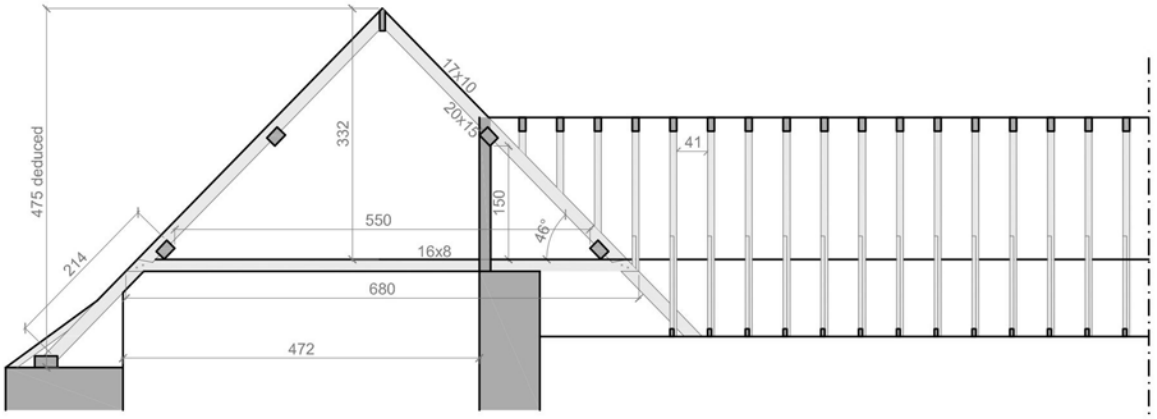
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

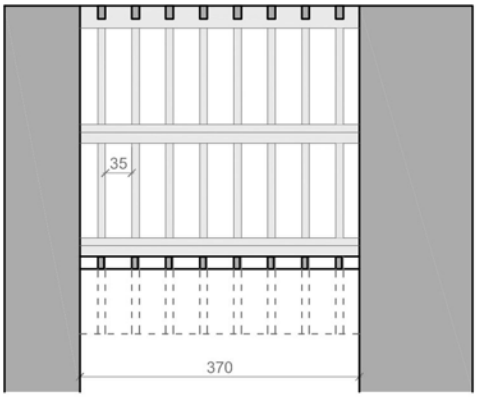
Section aa'



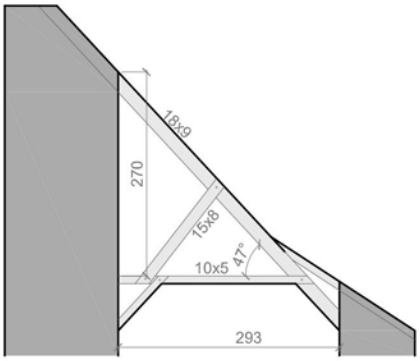
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section cc'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** STIRLING CASTLE_PALACE | **Roof location** 1: NW corner

Survey date(s) 01/10/2014 | See drawing: SCP-W-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 3.7 | Roof Height [m]: 4.75

Roof Pitch/es [°]: 46 | Roof Length [m]: 7

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]: 2

Type of Secondary Structure: common rafters, sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables: purlins

Roof Construction Period: From 1700 To 1725 Identified by: Estimated

Roof General Description: Western section of north range is gabled roof supported by 4 purlins, 2 on each side, and common rafters, connected by collars. There is a closed up window on the Eastern gable, suggesting it was originally an external gable. It seems reasonable to think this roof is part of a later construction phase. The purlins are oak, and they have redundant mortice and tenon joints, suggesting they are of earlier date and were reused.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: 20 B 15

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description: Rafters' apex: simple contact on a thin ridge purlin; between rafters and collars: dovetail lap secured by metal nails; between purlins and rafters: simple contact, rafters notched.

Wood Species: all pinus sylvestris except for the purlins which are oak

Way of identification: direct micro

Carpentry Marks Types

Carpentry Marks Description

Signs of reused timbers: Redundant mortice and tenon joints on purlins

Timber Treated ☐

Other Materials

Dendrochronology: carried out on samples from ceiling oak timbers and dated to 15th and 16th century - probably both Scottish and Baltic source (Crone & Fawcett 1998)



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: ridge support | link I:\Arch\A



Redundant joints in purlins | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not visible

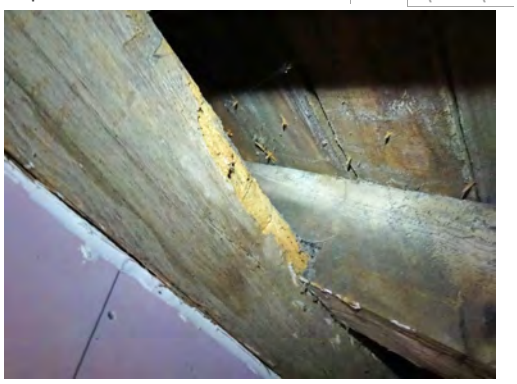
Past interventions: fire partition inserted between this roof and the west range. Some sarking replaced.



Fire partition | link I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☑ Humidity stains ☐ Diffuse insect exit holes ☑

Some insect and possibly fungi attack on the upper South purlin.



insect attack on purlin | link I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			



possible fungi attack on purlin | link I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage

link

Other Notes: The palace was built in 1539-42 but Hanke suggests that the roofs were replaced later. According to him, they belong to 3 different construction phases. Diversities only in structural composition, not in details of joining or materials. The Palace saw extensive building operations in late 16C, 17C and early 18C.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

INITIAL SURVEY | **Building name** STIRLING CASTLE_PALACE | **Roof location** 3: W range

Survey date(s) 01/10/2014 | See drawing: SCP-W-1

Roof Geometry: Shed

Roof Max Span [m]: 2.9 | Roof Height [m]: 3.4

Roof Pitch/es [°]: 47 | Roof Length [m]: 13.5

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Other

Average Distance in between Primary Structure [m]

Type of Secondary Structure: sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: None

Connection with gables

Roof Construction Period: From 1700 To 1725 | Identified by: Estimated

Roof General Description: Shed roof supported by common rafters with sprocket rafters. Slanted struts link the rafters to collars that support the ceiling. Rafters and collars are all half logs (roughly squared with a hand axe and then sawn in two). The struts are of later date, maybe early 19C. The roof was probably a two-pitch gabled roof like the others, but half of the building has collapsed.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 18 | B: 9 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: lapped

Fasteners Types: Metal nail

Joints description: All lapped secured by metal nails

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: strange marks (from scandinavia?)

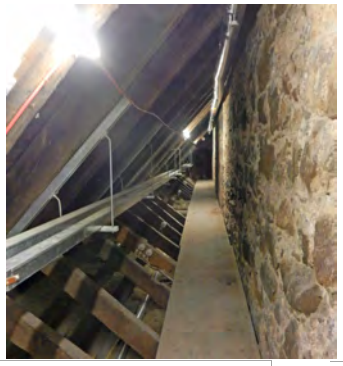
Carpentry Marks Description

Signs of reused timbers

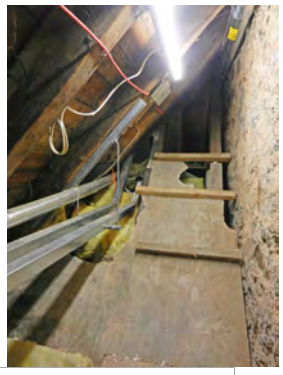
Timber Treated ☐

Other Materials

Dendrochronology: carried out on samples from ceiling oak timbers and dated to 15th and 16th century - probably both Scottish and Baltic source (Crone & Fawcett 1998)



Roof structure | link | I:\Arch\A



Intersection with south range | link | I:\Arch\A



Joints: rafter and strut | link | I:\Arch\A



Carpentry marks | link | I:\Arch\A



Carpentry marks | link | I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐



Decorative features

Unfavourable conditions

Accessibility limitations

Past interventions: The struts have probably been added in 19C. The sarking is more recent.

link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☑ Humidity stains ☐

Diffuse insect exit holes ☑

Some insect attack in rafters

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

link I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

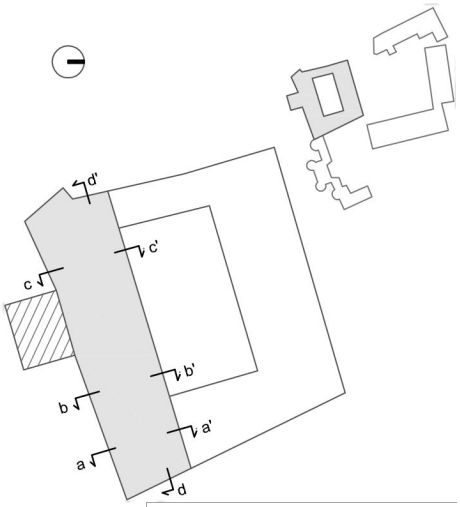
Description of visible damage

link

Other Notes: The palace was built in 1539-42 but Hanke suggests that the roofs were replaced later. According to him, they belong to 3 different construction phases. Diversities only in structural composition, not in details of joining or materials. The Palace saw extensive building operations in late 16C, 17C and early 18C.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui

link



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

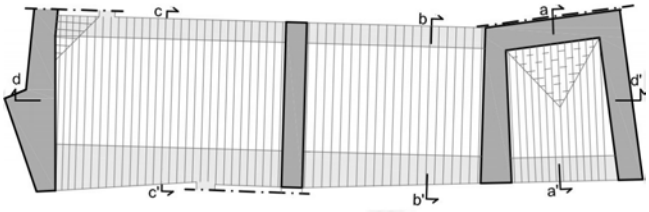
Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks

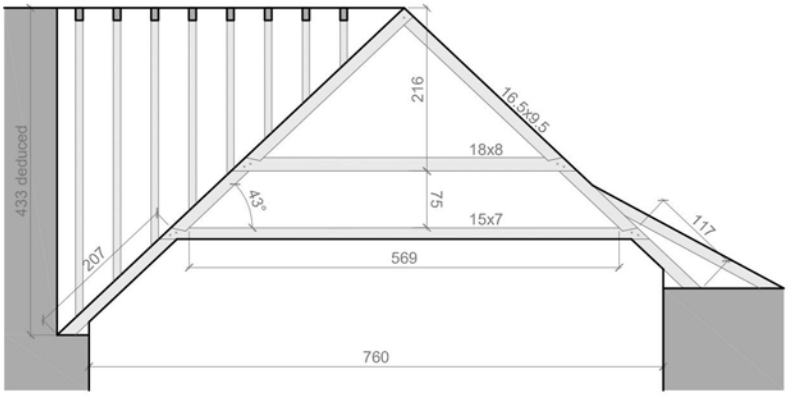
Carpentry marks from east to west

XXVII	I	not visible	XIX	XXI	VIIII
II	not visible	XIII	VI	XX	not visible
III	*WALL	not visible	not visible	XIII	not visible
IIII	not visible	not visible	*WALL	XVIII	not visible
V	not visible	XVI	not visible	XVII	not visible
not visible	III	XVII	not visible	XVI	IV
VI	V	XVIII	not visible	XV	III
not visible	IIII	VII	XXVI	XIV	II
X	VI	not visible	ΛXX	not visible	not visible
XVI	VII	V	not visible	XII	not visible
II	VIII	XII	XXIII	X\	
III	IX	XXIII	XXII	XI	

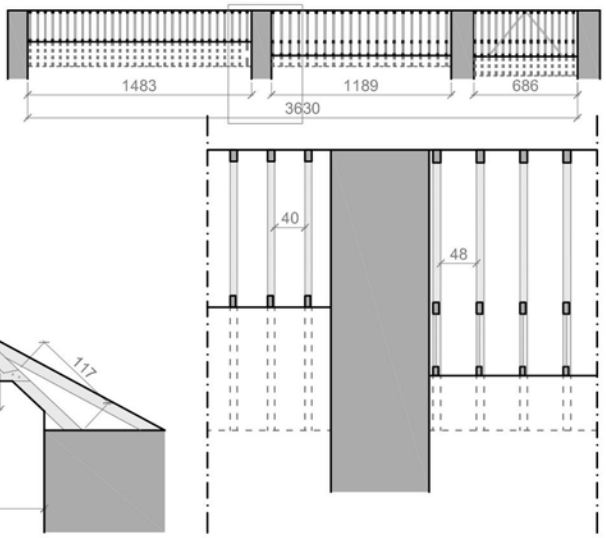


Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa'



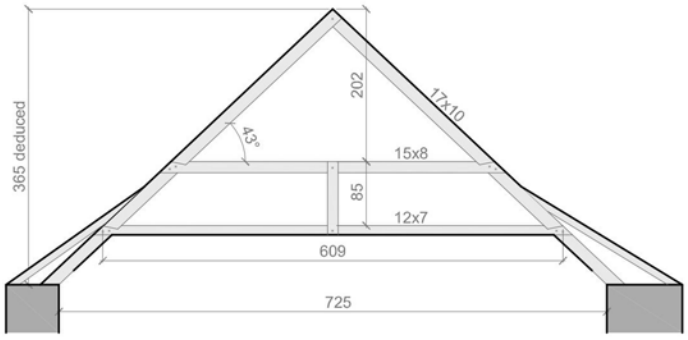
Section dd'



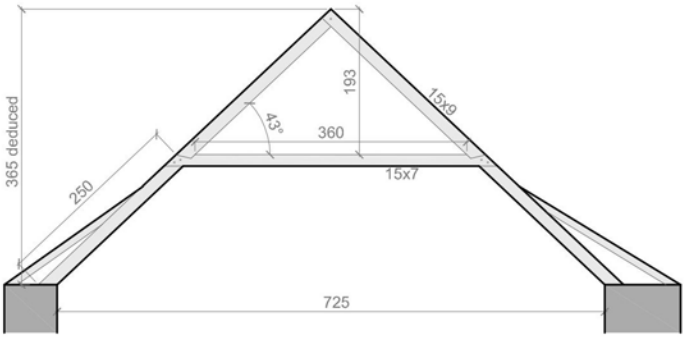
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section cc'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Ceiling supported by roof structure I:\Arch\A

INITIAL SURVEY | **Building name** STIRLING CASTLE_PALACE | **Roof location** 4: S range

Survey date(s) 01/10/2014 | See drawing: SCP-S-1

Roof Geometry: Two-pitch gabled with intersections

Roof Max Span [m]: 7.25 | Roof Height [m]: 4.33

Roof Pitch/es [°]: 43 | Roof Length [m]: 36.2

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking

Sarking boards: width [cm] 27 | thickness [cm] 3

Connection with lateral walls: Unknown

Connection with gables: sarking interrupted (chimney), wall-plate

Roof Construction Period: From 1700 To 1725 | Identified by: Estimated

Roof General Description: Gabled roof supported by 2 intermediate gable walls and 14 frames in the East section, 21 frames in the middle section and 30 frames in the West section. Frames have 2 collars in East and middle section, 1 collar in the West section (but redundant joints on all rafters suggest that there was a lower collar in the West section as well). Middle section frames have vertical struts too. The lower collars support the ceiling. Rafters and collars are all half logs (roughly squared with a hand axe and then sawn in two).

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 16 | B: 9.5 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description: Rafters' apex: half lap joint secured by 1 or 2 metal nails: between rafters and collars: dovetail lap joints secured by 2 metal nails.

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals, strange marks (from scandinavia?)

Carpentry Marks Description: Not all numbers are visible, but the visible ones are mostly in sequence.

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology: carried out on samples from ceiling oak timbers and dated to 15th and 16th century - probably both Scottish and Baltic source (Crone & Fawcett 1998)



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not visible. Lower collars 'packed' in plastic sheets and therefore inaccessible for inspection.

Past interventions: Some collars doubled. Some sarking replaced.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

Most timbers show diffuse insect exit holes on all faces, which probably correspond to past insect attack confined to the sapwood. Some timbers also show signs of active localized insect attack. Efflorescence on sarking on South side.



localized insect attack on rafter | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

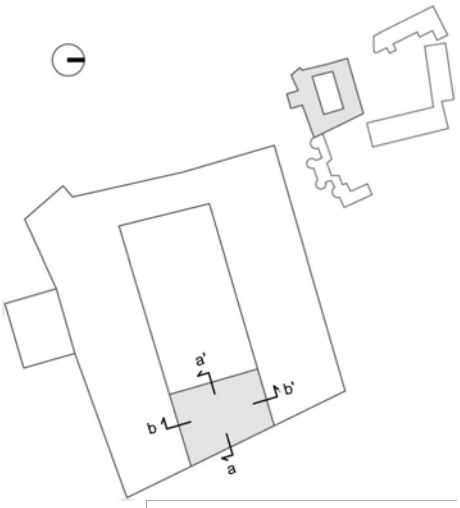
link

Description of visible damage

link

Other Notes: The palace was built in 1539-42 but Hanke suggests that the roofs were replaced later. According to him, they belong to 3 different construction phases. Diversities only in structural composition, not in details of joining or materials. The Palace saw extensive building operations in late 16C, 17C and early 18C.

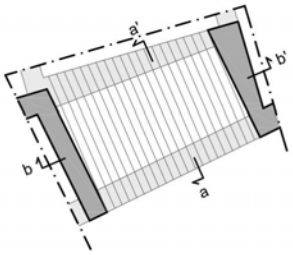
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Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



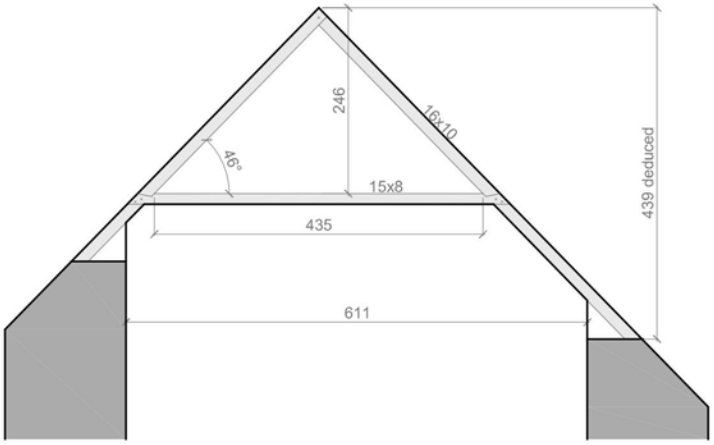
Carpentry marks from north to south

II
III
IIII
V
VI
VII
VIII
not visible
XIV
IX/X
XII
XIII
XIV
XV
not visible
XVIII
not visible
not visible
XXI
not visible

Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

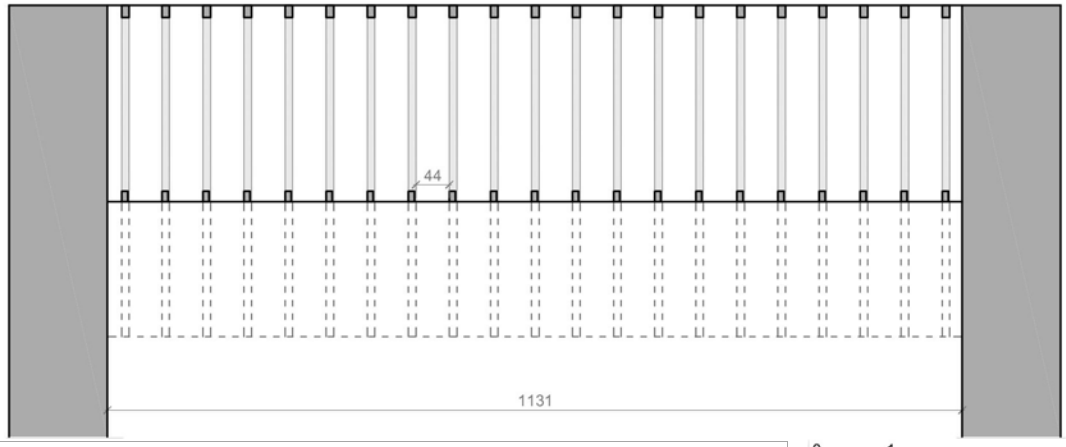
Section aa'



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5



Roof from outside I:\Arch\A

INITIAL SURVEY | **Building name** STIRLING CASTLE_PALACE | **Roof location** 5: E range

Survey date(s) 01/10/2014 | See drawing: SCP-E-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 6.1 | Roof Height [m]: 4.39

Roof Pitch/es [°]: 46 | Roof Length [m]: 11.3

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables

Roof Construction Period: From 1700 To 1725 | Identified by: Estimated

Roof General Description: Gabled roof supported by 21 frames with one collar.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 16 B: 10 | Or Purlin - H: B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Mostly in sequence

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology: carried out on samples from ceiling oak timbers and dated to 15th and 16th century - probably both Scottish and Baltic source (Crone & Fawcett 1998)



Roof structure | link I:\Arch\A

link I:\Arch\A

link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall not visible

Past interventions

link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☑

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

link I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

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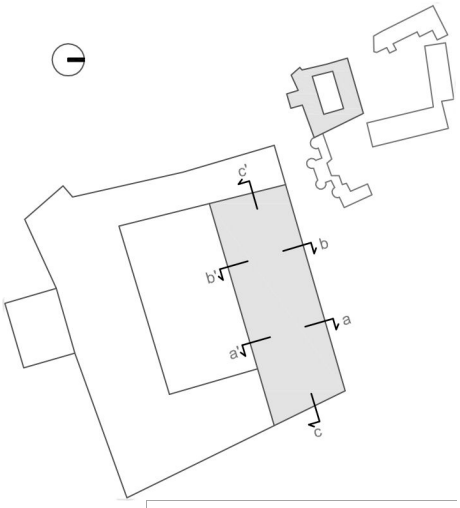
Description of visible damage

link

Other Notes: The palace was built in 1539-42 but Hanke suggests that the roofs were replaced later. According to him, they belong to 3 different construction phases. Diversities only in structural composition, not in details of joining or materials. The Palace saw extensive building operations in late 16C, 17C and early 18C.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui

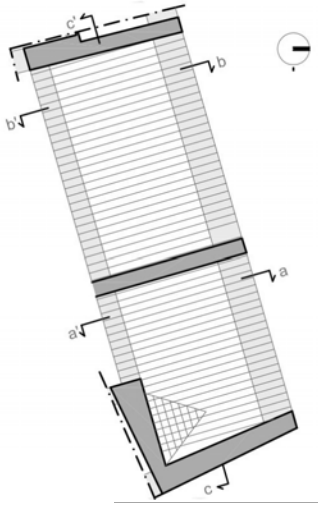
link



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



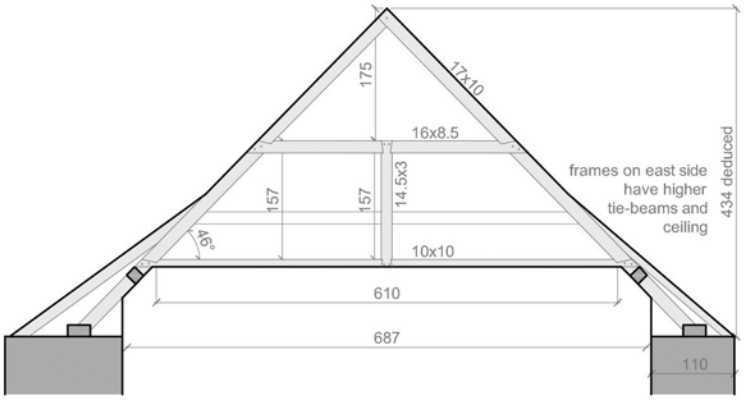
Carpentry marks from west to east:

XVIII	XVII	IIII
XVI	not visible	Λ
XI	VII	not visible
XX	XV	not visible
IX	VI	IV
V	XXIII	III
VIX	IIII	II
III	not visible	I
XIII	not visible	not visible
ΛIII	* WALL	not visible
XXII	not visible	not visible
XXI	II	not visible
XX	not visible	
XIX	not visible	
X	V	
XXIV	VI	
XII	VII	
XI	VIII	
XXVI	not visible	
XVIII	not visible	
III	XI	

Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

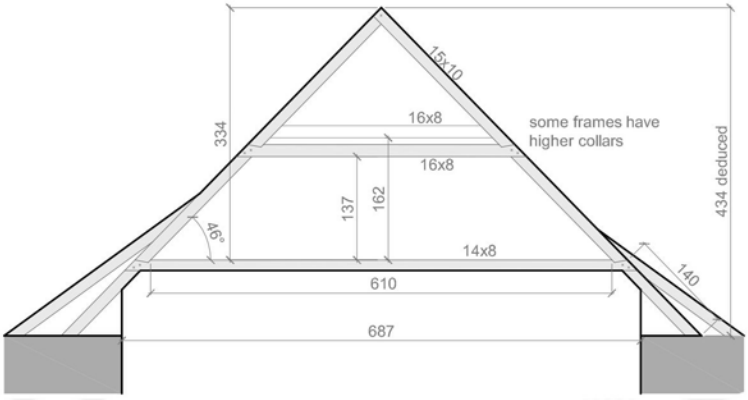
Section aa'



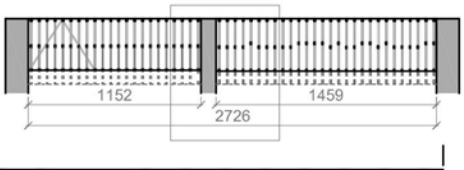
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

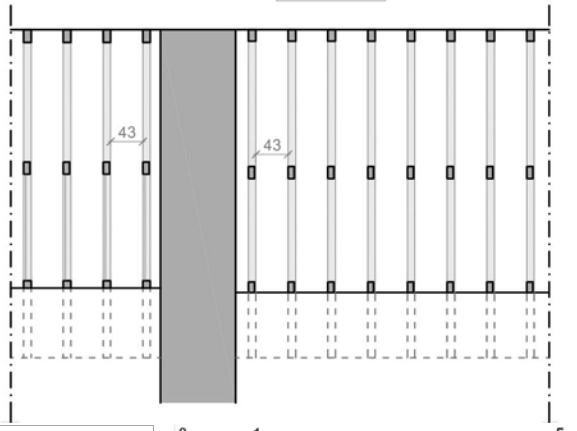
Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section bb'



Section cc'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

INITIAL SURVEY | **Building name** STIRLING CASTLE_PALACE | **Roof location** 2: N range

Survey date(s) 01/10/2014 | See drawing: SCP-N-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 7 | Roof Height [m]: 4.34

Roof Pitch/es [°]: 46 | Roof Length [m]: 27.26

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s, Struts

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: purlins, sarking

Sarking boards: width [cm] 27 | thickness [cm] 2.5

Connection with lateral walls: None, Wall-plate

Connection with gables: sarking interrupted (chimney), wall-plate

Roof Construction Period: From 1700 To 1725 | Identified by: Estimated

Roof General Description: Gabled roof with an intermidiate gable wall: 22 frames on East side and 30 frames on West side. The external gable walls are made of rubble masonry, the intermediate one is in ashlar masonry. Frames have 2 collars each and sprockets on both sides. The lower collars support the ceiling. In the East section are vertical struts too, connecting the two collars. There is a small cross roof to the North-East with timbers of later date (probably 19C). Rafters and collars are all half logs (roughly squared with a hand axe and then sawn in two).

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: 16 | B: 10 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: dovetail, lapped

Fasteners Types: Metal nail

Joints description: Rafters' apex: simple lap joints, secured with one or two nails; between rafters and collars and collars and struts: dovetail lap joints secured with 2 nails

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Not all of the numbers are visible, but the visible ones are not in sequence

Signs of reused timbers

Timber Treated ☐

Other Materials

Dendrochronology: carried out on samples from ceiling oak timbers and dated to 15th and 16th century - probably both Scottish and Baltic source (Crone & Fawcett 1998)



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joint: rafter and collar | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: The lower collars are all 'packed' in plastic sheets and are therefore inaccessible for inspection.

Past interventions: Works finished in 2009: some sarking amd sprocket rafters replaced, insulation added on the ceiling. In the West part some collars have been lowered and new collars and vertical hangers added. In the East part some vertical struts have been removed, some replaced.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Intermediate gable wet on the East side: the masonry is disintegrating and falling on the timbers and the ceiling. Humidity stains on sarking and rafters look old. Most timbers show diffuse insect exit holes on all faces, which probably correspond to past insect attack confined to the sapwood. Some timbers also show signs of localized active insect attack.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage			

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

link

Description of visible damage

link

Other Notes: The palace was built in 1539-42 but Hanke suggests that the roofs were replaced later. According to him, they belong to 3 different construction phases. Diversities only in structural composition, not in details of joining or materials. The Palace saw extensive building operations in late 16C, 17C and early 18C.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui | link

DETAILED SURVEY **Building name** STIRLING CASTLE_PALACE **Roof location** 3: W range

Survey date(s) 10/02/2016 07/04/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SCP-W-1, SCP-W-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafter	465	rectangular	bending, compression	pinus sylvestris	3 hand axed faces and 1 hand sawn
Collar	260	rectangular	bending, compression		3 hand axed faces and 1 hand sawn
Upper strut	175	rectangular	compression	pinus sylvestris	3 hand axed faces and 1 hand sawn, but some seem to be machine sawn
Sprocket Rafter		rectangular	bending, compression		
Lower strut					
Sarking		sheet	bending, tension	pinus sylvestris	some hand sawn, some machine sawn

* estimated based on drawings because not fully accessible

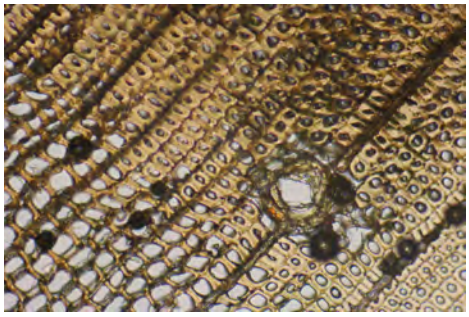
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SCP-W-1, SCP-W-2

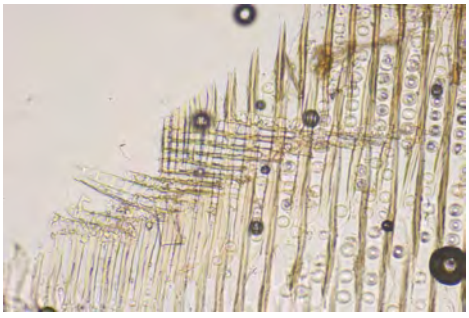
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & collar	Encounter simple lap	compression	nails	
upper strut & other	Encounter simple lap	compression	nails	
lower strut & collar	Encounter simple lap	compression	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

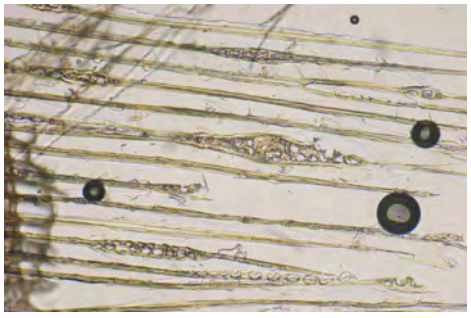
Microscopic identification of the timber species See drawing SCP-W-2



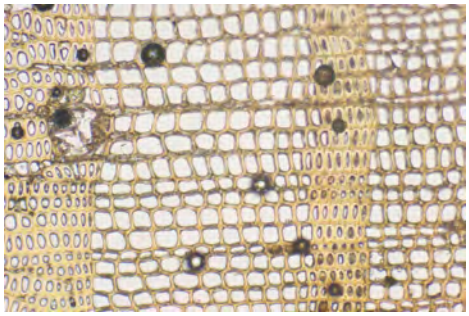
Rafter: transv. Section x100 I:\Arc



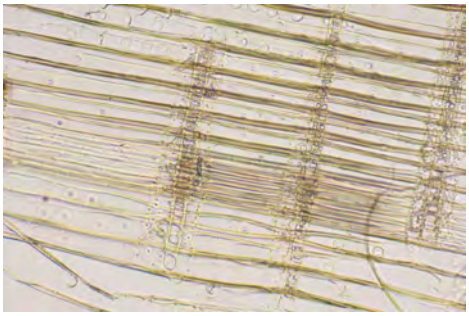
Rafter: radial section x100 I:\Arc



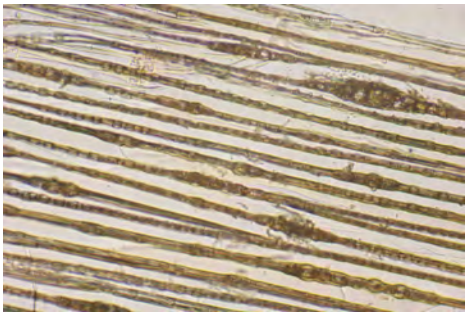
Rafter: tang. section x 100 I:\Arc



Upper strut: transv. Section x100 I:\Arc



Upper strut: radial section x100 I:\Arc



Upper strut: tang. Section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing SCP-W-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	S side	10/02/2016	11:15 am	10	72
roof space	N side	10/02/2016	11:30 am	10.3	73.4

Frame/Truss name non visible 25 See drawing SCP-W-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other

Frame/Truss name non visible 15 See drawing SCP-W-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other

Element name A rafter

Dating original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type: section not well squared, rounded on one side

Section: nominal size (hxb) [cm] 16.3x8.8 | min. size (hxb) [cm] 16x8.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%] 4 tangential

Knots [min d/section h] 1/15.5 single | Knotty element ☑ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Element name B strut

Dating later | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15x8 | min. size (hxb) [cm] 15x8 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 3 | tangential

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ Type: | Status: | Way of identification:

Fungi attack ☐ Type: | Status: | Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: | Way of identification:

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Frame/Truss name non visible 4 | See drawing SCP-W-2

Missing elements: | Elements with defects in critical area: rafter

Joints with decayed peg: | Insect attack:

Failed joints: | Fungi attack:

Other:

Element name A rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues: upper end not visible because incorporated in wall

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 15.3x9 | min. size (hxb) [cm]: 15x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 8 | tangential

Knots [min d/section h]: 3/9 | single | Knotty element ☑ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects: shake near centre

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type: | Status: | Way of identification:

Fungi attack ☐ Type: | Status: | Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name B strut

Dating later
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 14.5x7 min. size (hxb) [cm] 14x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 7 tangential
Knots [min d/section h] 2/7 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Frame/Truss name non visible 25 See drawing SCP-W-2

Missing elements
Elements with defects in critical area
Joints with decayed peg
Insect attack rafter
Failed joints
Fungi attack
Other

Element name A rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 16x8.3 min. size (hxb) [cm] 15.5x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 9 tangential
Knots [min d/section h] 1/9 single Knotty element ☑ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification



insect attack I:\Arc

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐ External actions ☐ Other ☐

Element name B strut

Dating later Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.7x7.2 min. size (hxb) [cm] 15x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 4/15 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐ External actions ☐ Other ☐

Frame/Truss name non visible 20 See drawing SCP-W-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack strut

Failed joints Fungi attack

Other

Frame/Truss name	**non visible 12**	See drawing SCP-W-2	
Missing elements		Elements with defects in critical area	
Joints with decayed peg		Insect attack	rafter
Failed joints		Fungi attack	
Other			

Frame/Truss name	**non visible 6**	See drawing SCP-W-2	
Missing elements		Elements with defects in critical area	
Joints with decayed peg		Insect attack	rafter
Failed joints		Fungi attack	
Other			

Frame/Truss name	**non visible 6**	See drawing SCP-W-2	
Missing elements		Elements with defects in critical area	
Joints with decayed peg		Insect attack	rafter
Failed joints		Fungi attack	
Other			

DETAILED SURVEY **Building name** STIRLING CASTLE_PALACE **Roof location** 1: NW corner

Survey date(s) 10/02/2016 07/04/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SCP-NW-1, SCP-NW-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Purlins	370	rectangular	bending	quercus sp.	hand axed
Common rafters	640	rectangular	bending, compression	pinus sylvestris	3 hand axed faces and one hand sawn
Collars	680	rectangular	bending, compression, tension		
Sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

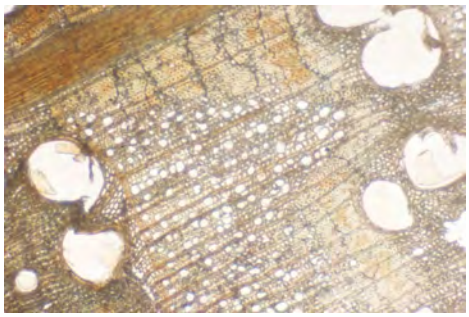
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SCP-NW-1, SCP-NW-2

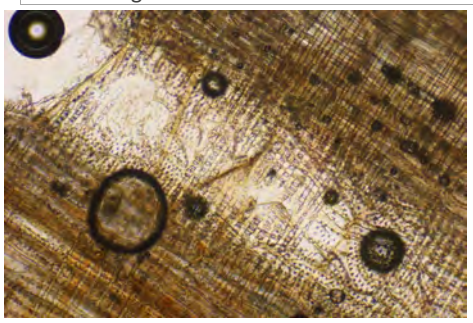
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafters & collars	Encounter dovetail	compression, tension	nails	
rafters & purlins	Encounter simple contact	compression	none	
rafter & rafter	Encounter simple contact	compression	none	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

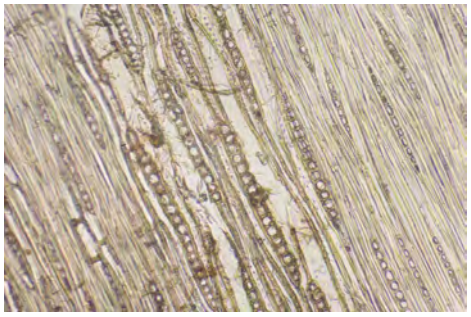
Microscopic identification of the timber species See drawing SCP-NW-2



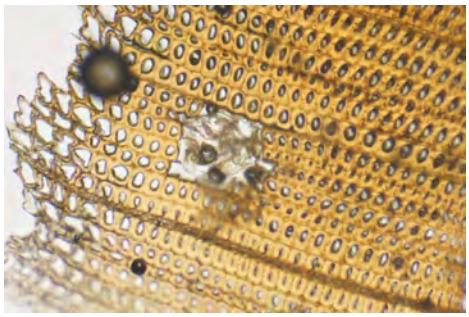
Purlin: transv. Section x40 I:\Arc



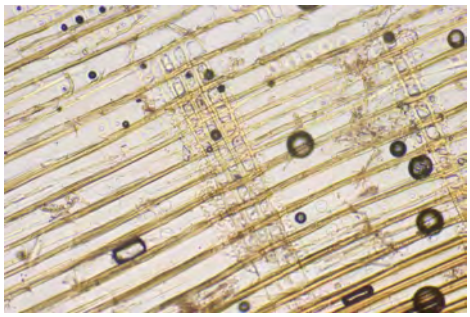
Purlin: radial section x 100 I:\Arc



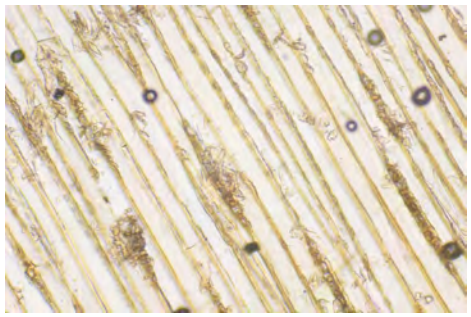
Purlin: tang. Section x100 I:\Arc



Sarking: transv. Section x100 I:\Arc



Sarking: radial section x100 I:\Arc



Sarking: tang. Section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing SCP-NW-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	centre	10/02/2016	10:45 am	11.5	65

roof space	centre	16/06/2016	4 pm	19.6	62.2

Frame/Truss name all roof — See drawing SCP-NW-2

Missing elements | Elements with defects in critical area: purlin b

Joints with decayed peg | Insect attack: purlin b & c

Failed joints | Fungi attack: purlin b & c

Other

Element name A purlin

Dating: original construction | Signs of reuse: redundant mortice and tenon joint close to the West end

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 17.8x14.6 | min. size (hxb) [cm]: 17x14 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 5 | tangential

Knots [min d/section h]: 3/19 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other



redundant joint on purlin | I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐ | External actions ☐ | Other ☐

Element name B purlin

Dating: original construction | Signs of reuse: redundant mortice and tneon joint near the East end

Timber treated ☐ | Accessibilityissues

Past interventions: there are signs of coring

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 18x15.8 | min. size (hxb) [cm]: 17x15.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: centre | Slope of grain [%]: 5 | tangential

Knots [min d/section h]: 2.5/16 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☑

Other defects

Estimated Strength Class according to UNI 11119: lower than III



insect & possible fungi attack | I:\Arc

Material degradation

Insect attack ☑ Type: Anobium Punctatum Status: unknown
Way of identification: Estimated

Fungi attack ☑ Type: Unknown Status: unknown
Way of identification:

Corrosion ☐ Wet surface ☐ Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: Emergency interv. needed ☐

Mater.Degr. and Damage Extent: the decay seems to be limited to the sapwood (3cm depth maximum)

Way of identification: visual inspection

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name C purlin

Dating: original construction Signs of reuse:

Timber treated ☐

Past interventions:

Accessibilityissues:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 18.8x14.8 min. size (hxb) [cm]: 18.5x14.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: centre Slope of grain [%]: 12 tangential

Knots [min d/section h]: 4/15 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II



possible fungi attack | I:\Arc

Material degradation

Insect attack ☑ Type: Anobium Punctatum Status: unknown
Way of identification: Estimated

Fungi attack ☑ Type: Unknown Status: unknown
Way of identification:

Corrosion ☐ Wet surface ☐ Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: Emergency interv. needed ☐

Mater.Degr. and Damage Extent:

Way of identification:

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Element name D purlin

Dating: original construction Signs of reuse:

Timber treated ☐

Past interventions: there are signs of coring

Accessibilityissues: the Eastern half of the purlin is not visible

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm] 19x16 min. size (hxb) [cm] 19x16 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 6 tangential

Knots [min d/section h] 5/15 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage

Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

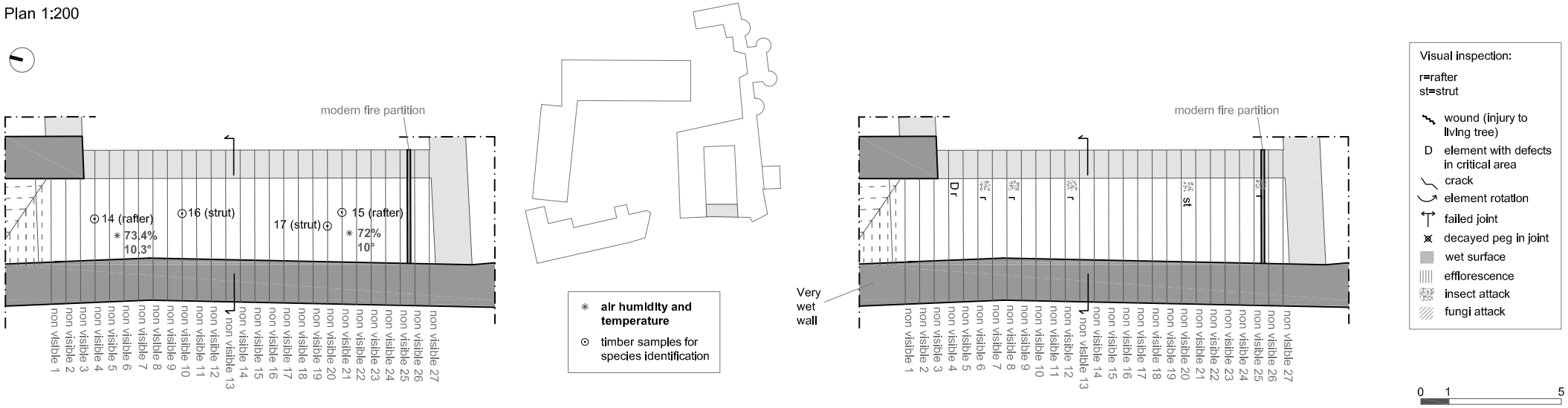
Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

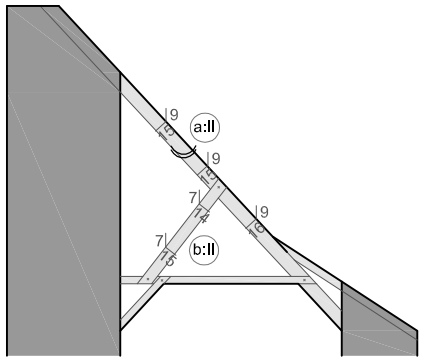
Plan 1:200



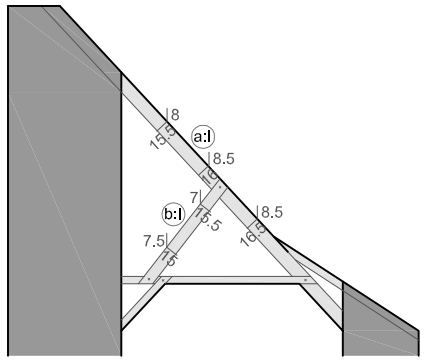
Sections 1:100 (looking North)

Visual inspection:
- higly inclined slope of grain
- big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

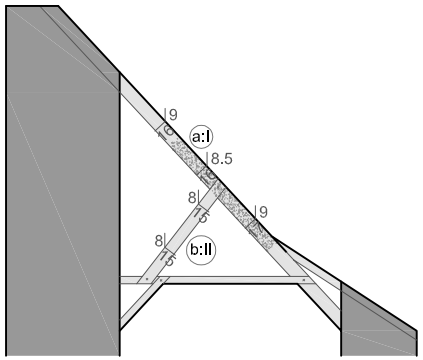
Frame nv4



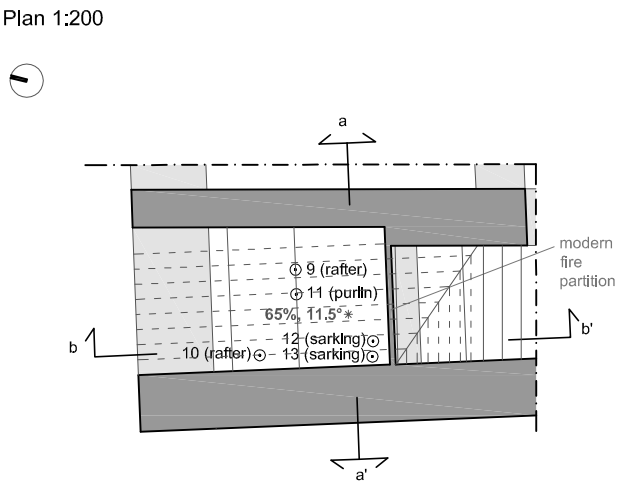
Frame nv15

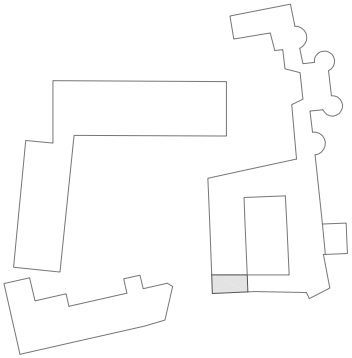


Frame nv25

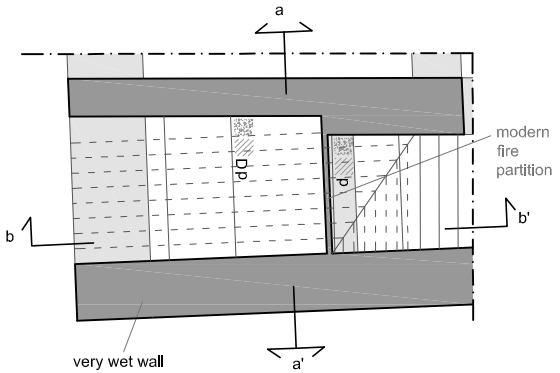


Plan 1:200





* air humidity and temperature
⊙ timber samples for species identification



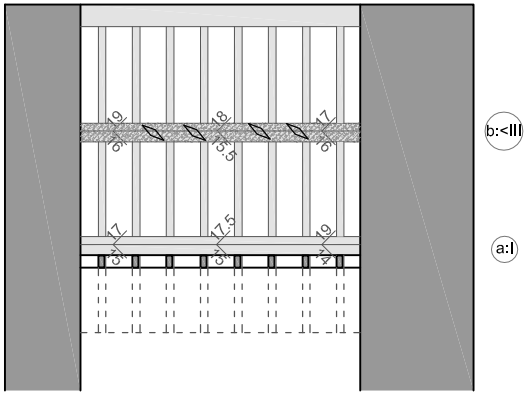
Visual inspection:
p=purlin
r=rafter
sk=sarking
wound (injury to living tree)
D element with defects in critical area
crack
element rotation
failed joint
decayed peg In joint
wet surface
efflorescence
insect attack
fungi attack

0 1 5

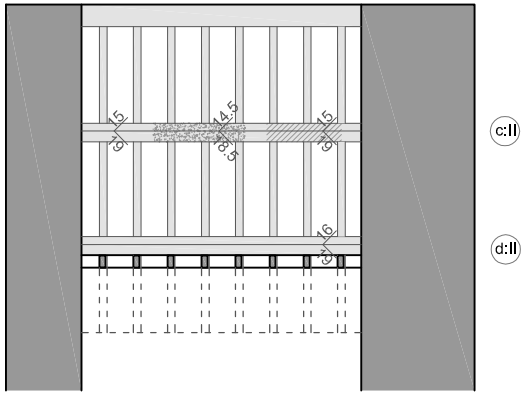
Sections 1:100 (looking North)

Visual inspection:
higly inclined slope of grain
@ big knots (f=front, r=rear, s=sides)
checks on both sides
shake
wound (injury to living tree)
crack
element rotation
open joint
x:x element name : estimated strength class (na=less than 2 faces visible)
wet surface
efflorescence
decayed peg
insect attack
fungi attack

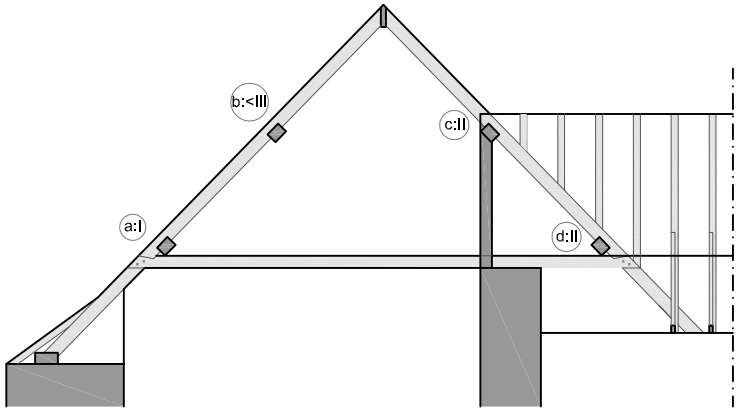
Section aa'1:100 (looking North)



Section aa' 1:100 (looking South)



Section bb' 1:100 (looking East)



DETAILED SURVEY **Building name** STIRLING CASTLE_PALACE **Roof location** 4: SW range

Survey date(s) 10/02/2016 07/04/2016 20/05/2016 16/06/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SCP-SW-1, SCP-SW-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafters	530	rectangular	bending, compression	pinus sylvestris	3 hand axed faces and 1 hand sawn
Collars	440	rectangular	bending, compression, tension	pinus sylvestris	the visible face is hand axed
Sarking		sheet	bending, tension	pinus sylvestris	hand sawn
Sprocket rafters		rectangular	bending, compression		

* estimated based on drawings because not fully accessible

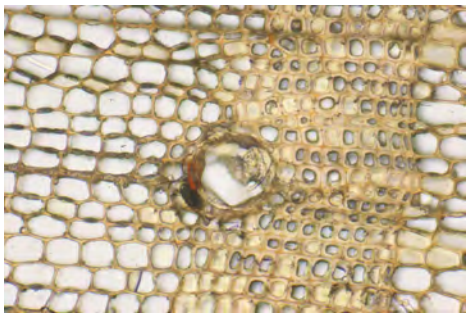
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SCP-SW-1, SCP-SW-2

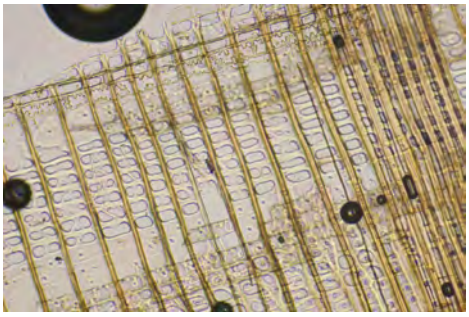
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter	Corner halved	compression	nails	
rafter & collar	Encounter dovetail	compression, tension	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

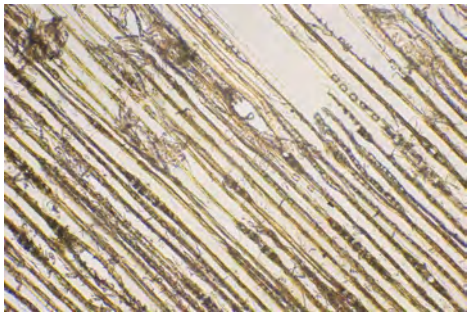
Microscopic identification of the timber species See drawing SCP-SW-2



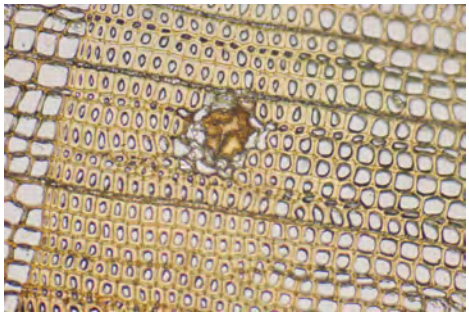
Rafter: transv. Section x100 I:\Arc



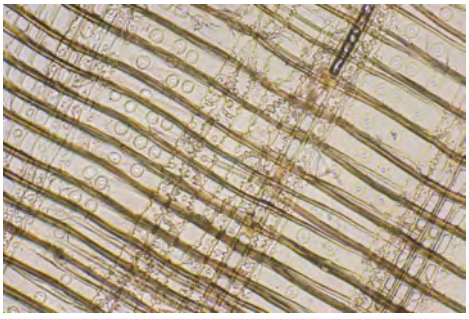
Rafter: radial section x100 I:\Arc



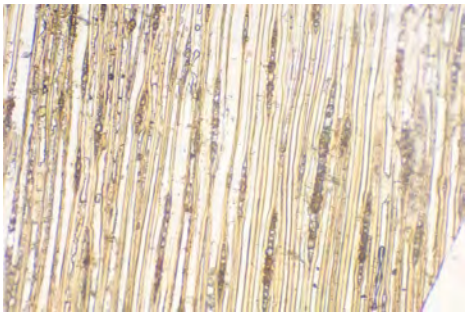
Rafter: tang. Section x50 I:\Arc



Sarking: transv. Section x100 I:\Arc



Sarking: radialection x100 I:\Arc



Sarking: tang. section x50 I:\Arc

Air Temperature and Relative Humidity measurements See drawing SCP-SW-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	W side	10/02/2016	12 am	13	59

roof space	E side	10/02/2016	12 am	13.7	55.6
roof space	E side	20/05/2016	10 am	18.4	53
roof space	W side	20/05/2016	10:15 am	18.2	54.5
roof space	E side	16/06/2016	2:15 pm	22	54
roof space	W side	16/06/2016	2 pm	21.5	57

Frame/Truss name XII — See drawing SCP-NE-5

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack: S rafter

Failed joints | Fungi attack

Other

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type: upper part has a trapezoid section: depth reduced to 1.7cm

Section: nominal size (hxb) [cm]: 17.3x6.9 | min. size (hxb) [cm]: 17x1.7 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



insect attack, probably old | I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: non-active

Way of identification: Estimated

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: external section reduction up to 2cm and internal decay up to 2cm (points a-a')

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

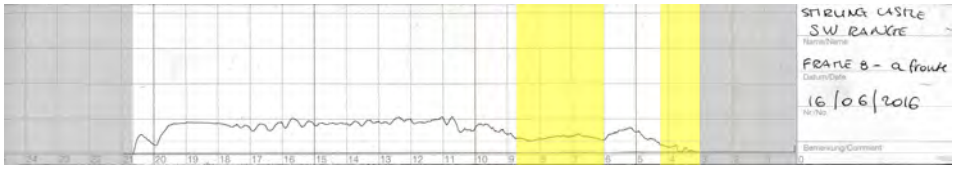
Moisture Content [%]: 11.8 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☑

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 12.8

Link to Micro-drill graph: I:\Arc



LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point a'

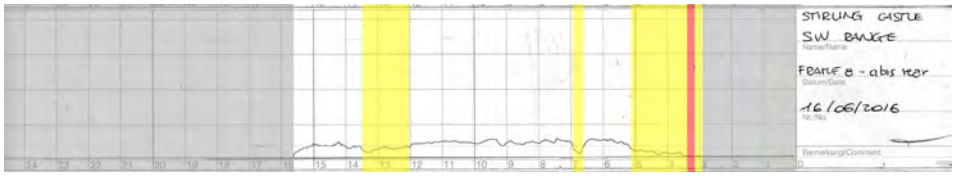
Moisture Content [%] | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]: 19.7

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

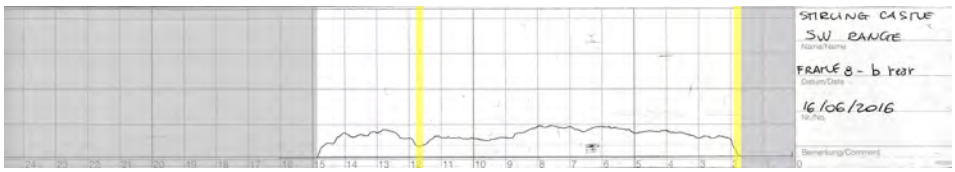
Moisture Content [%]: 11.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1145 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: 7.9

Material Degradation based on Micro-drill [%]: 2.5

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

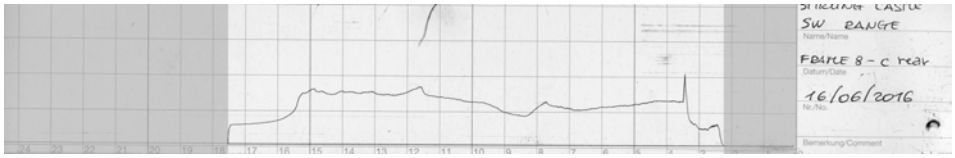
Moisture Content [%]: 9.7 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1501 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -6.2

Material Degradation based on Micro-drill [%]: 0

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name VIIII | See drawing SCP-SW-5

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack: S rafter

Failed joints | Fungi attack

Other

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 17.3x10.1 | min. size (hxb) [cm]: 17x10 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: active

Way of identification: Estimated

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role



insect attack on rafter | I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: external section reduction up to 3cm and internal decay up to 1.5cm

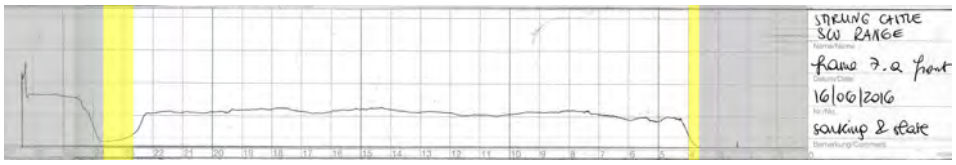
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]	11.8
Ultrasonic velocity [m/s]	1528
Density loss based on ultrasonic test [%]	-7.3
Material Degradation based on Micro-drill [%]	5.8
Link to Micro-drill graph	I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

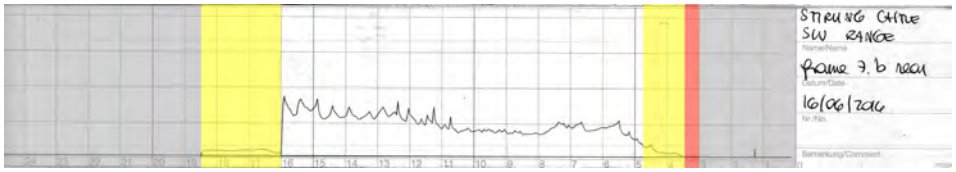


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]	16.2
Ultrasonic velocity [m/s]	1663
Density loss based on ultrasonic test [%]	-12.6
Material Degradation based on Micro-drill [%]	24
Link to Micro-drill graph	I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

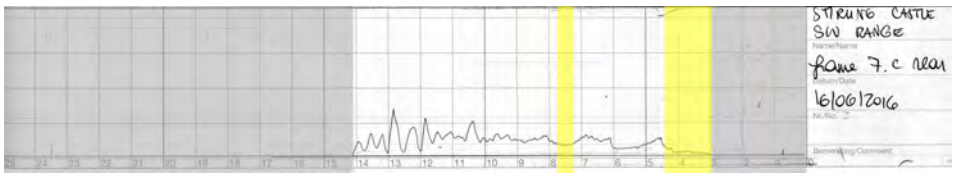


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]	12.3
Ultrasonic velocity [m/s]	1593
Density loss based on ultrasonic test [%]	-9.8
Material Degradation based on Micro-drill [%]	11.8
Link to Micro-drill graph	I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

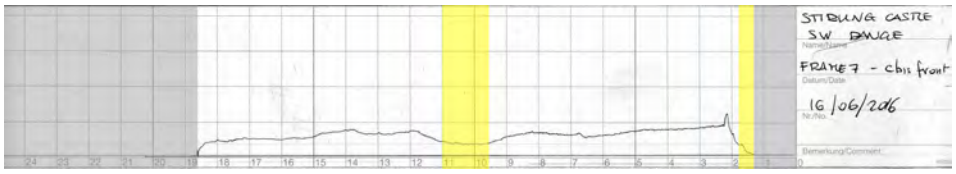


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c'

Moisture Content [%]	
Ultrasonic velocity [m/s]	
Density loss based on ultrasonic test [%]	
Material Degradation based on Micro-drill [%]	5.9
Link to Micro-drill graph	I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name not visible 5 — See drawing SCP-SW-4

Missing elements
Elements with defects in critical area
Joints with decayed peg
Insect attack
Failed joints
Fungi attack
Other efflorescence on upper face of S rafter

Element name A south rafter

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17x9 min. size (hxb) [cm] 16.5x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



efflorescence on upper face I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other efflorescence on upper face of the rafter

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 12.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1408 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -2.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 13.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1475 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -5.2

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 8.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1421 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name not visible 3 See drawing SCP-SW-4

Missing elements Elements with defects in critical area S rafter

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other: shakes all along S rafter

Element name A south rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 18.8x9 | min. size (hxb) [cm]: 18x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]:

Knots [min d/section h]: | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects: shakes all along the element

Estimated Strength Class according to UNI 11119:



shakes all along the element | I:\Arc

Material degradation

Insect attack ☐ | Type: | Status: | Way of identification:

Fungi attack ☐ | Type: | Status: | Way of identification:

Corrosion ☐ | Wet surface ☐ | Other:

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage: | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: shakes up to 0.4cm wide | Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 8.9 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1365 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -0.8

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 12.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1519 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -6.9

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

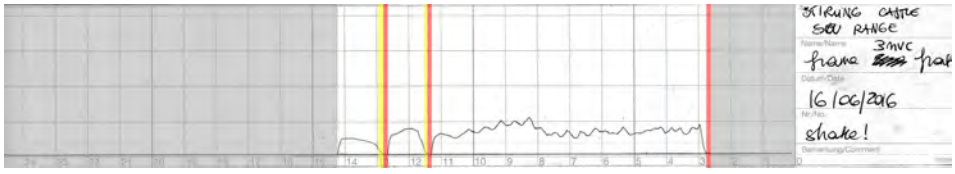
Moisture Content [%]: 13.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1236 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: 4.3

Material Degradation based on Micro-drill [%]: 6.5

Link to Micro-drill graph: I:\Arc



LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name II — See drawing SCP-SW-4

Missing elements | Elements with defects in critical area: N rafter

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other: wound on N rafter

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 15.3x8.5 | min. size (hxb) [cm]: 15x8 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects: shakes and a wound (injury to living tree)

Estimated Strength Class according to UNI 11119



wound (injury to living tree) | I:\Arc

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 12.4 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s]: 1666 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -12.7

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 12 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s]: 1680 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -13.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%] 13.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1534 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -7.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name not visible 10 See drawing SCP-SW-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13.8x7.9 min. size (hxb) [cm] 12.9x7.9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 2.7/8 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification NDT/SDT

Measurement Point a

Moisture Content [%] 11.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1469 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -4.9

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 12.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1547 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -8

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 11.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1655 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -12.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.8x9.3 min. size (hxb) [cm] 15.3x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential

Knots [min d/section h] 5.2/9 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 lower than III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other



big knot I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point d

Moisture Content [%] 11.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1732 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -15.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 11.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1455 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -4.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

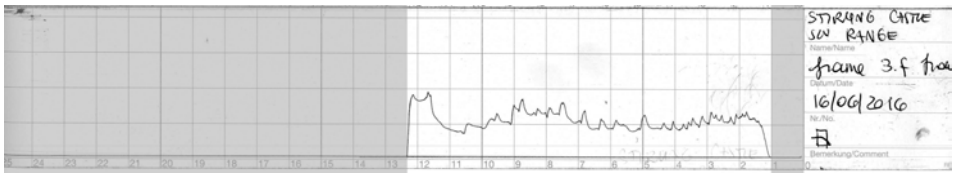
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 14.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1351 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -0.3



Material Degradation based on Micro-drill [%] 0

Link to Micro-drill graph I:\Arc

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name A collar

Dating Signs of reuse

Timber treated ☐ Accessibilityissues only one face partly visible because 'wrapped' in plastic

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] min. size (hxb) [cm] Single piece ☐ Jointed element ☐

Strength affecting defects

Pith location Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 12 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 13.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 14.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 13.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name XV See drawing SCP-SW-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15.9x8.9 min. size (hxb) [cm] 15.5x8.8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 7.5/9 Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 lower than III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role



big knot I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point d

Moisture Content [%]	11.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]	1527	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]	-7.2				
Material Degradation based on Micro-drill [%]					
Link to Micro-drill graph					

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%]	12.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]	1511	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]	-6.6				
Material Degradation based on Micro-drill [%]					
Link to Micro-drill graph					

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%]	11.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐
Ultrasonic velocity [m/s]	1445	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]	-4				
Material Degradation based on Micro-drill [%]					
Link to Micro-drill graph					

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north rafter

Dating: original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 16x8.7 min. size (hxb) [cm]: 15.5x8.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 9 tangential
Knots [min d/section h]: 2/14.9 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]	12	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐		
Ultrasonic velocity [m/s]	1533	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐			
Density loss based on ultrasonic test [%]	-7.4						
Material Degradation based on Micro-drill [%]							
Link to Micro-drill graph							

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]	11.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐		
Ultrasonic velocity [m/s]	1581	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐			
Density loss based on ultrasonic test [%]	-9.4						
Material Degradation based on Micro-drill [%]							
Link to Micro-drill graph							

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]	14.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐		
Ultrasonic velocity [m/s]	1576	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐			
Density loss based on ultrasonic test [%]	-9.2						
Material Degradation based on Micro-drill [%]							
Link to Micro-drill graph							

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C collar

Dating
Signs of reuse
Timber treated ☐
Accessibilityissues: only one face partly visible because 'wrapped' in plastic
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]
min. size (hxb) [cm]
Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location
Slope of grain [%]
Knots [min d/section h]
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%] 12 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 10.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 10.6 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 11.9 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name not visible 2 — See drawing SCP-SW-3

Missing elements | Elements with defects in critical area
Joints with decayed peg | Insect attack
Failed joints | Fungi attack
Other

Element name A south rafter

Dating original construction | Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 18.3x9 min. size (hxb) [cm] 18x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 2.5/18.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: Very limited external decay

Way of identification: NDT/SDT

Measurement Point a

Moisture Content [%] 12.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1521 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -7

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 11.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1427 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -3.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

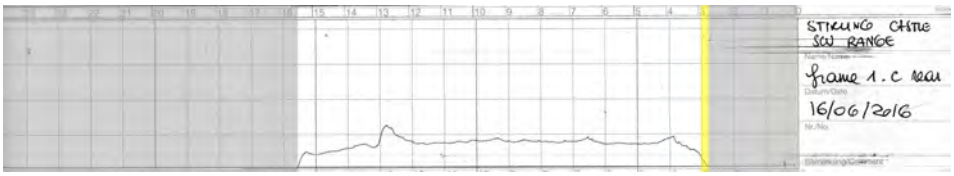
Moisture Content [%] 10.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1281 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] 2.5

Material Degradation based on Micro-drill [%] 1.7

Link to Micro-drill graph I:\Arc



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17x9 min. size (hxb) [cm] 16.5x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 8 tangential

Knots [min d/section h] 3.5/9 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Measurement Point d

Moisture Content [%] 12.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1700 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -14.1

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point e

Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1517 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -6.8

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point f

Moisture Content [%] 13.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1387 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -1.7

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C collar

Dating original construction Signs of reuse

Timber treated ☐

Accessibilityissues: only one face partly visible because 'wrapped' in plastic

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] | min. size (hxb) [cm] | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location | Slope of grain [%] | Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Measurement Point a

Moisture Content [%] 15.1 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%] 13.6 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%] 9.7 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

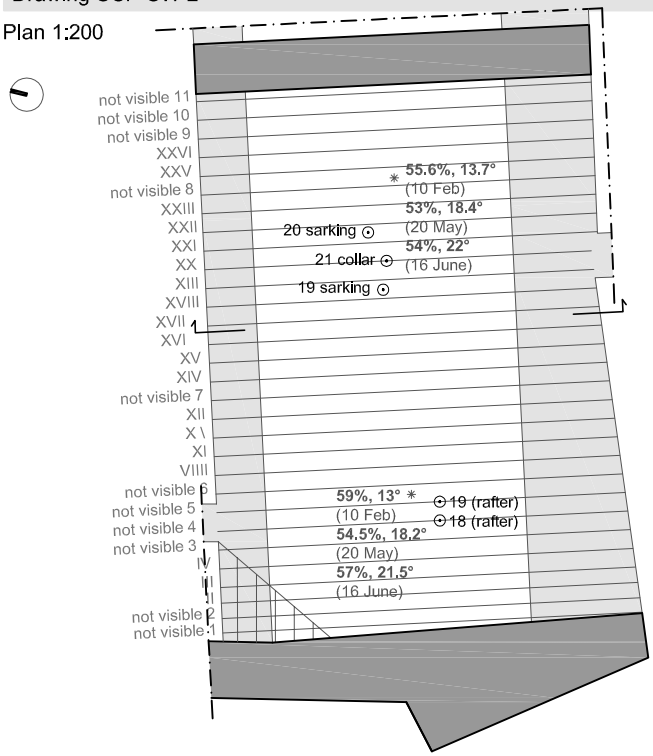
Material Degradation based on Micro-drill [%]

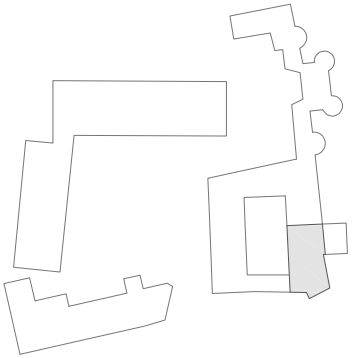
Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Building Name: Stirling Castle Palace | Roof Location: SW range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou
Drawing SCP-SW-2 | PhD thesis | Architecture Department, University of Strathclyde

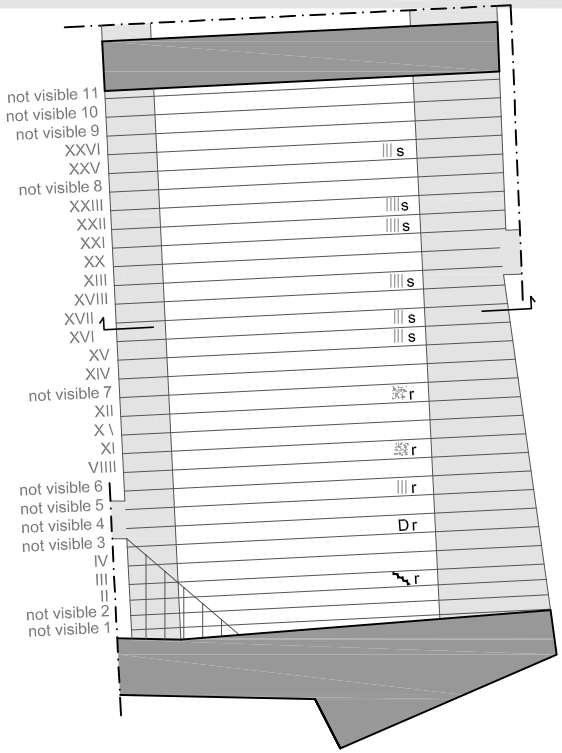
Plan 1:200





✳ air humidity and temperature

⊙ timber samples for species identification



Visual inspection:

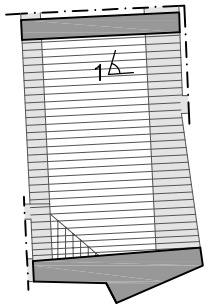
r=rafter
s=sarking

- wound (injury to living tree)
- D element with defects in critical area
- crack
- element rotation
- failed joint
- decayed peg in joint
- wet surface
- efflorescence
- insect attack
- fungi attack

0 1 5

Themographic images

Plan 1:500



1: areas with higher temperature show the position of the rafters behind the plaster in the attic spaces





Building Name: Stirling Castle Palace | Roof Location: SW range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou

Drawing SCP-SW-3 | PhD thesis | Architecture Department, University of Strathclyde

1000

Sections 1:100 (looking East)

Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

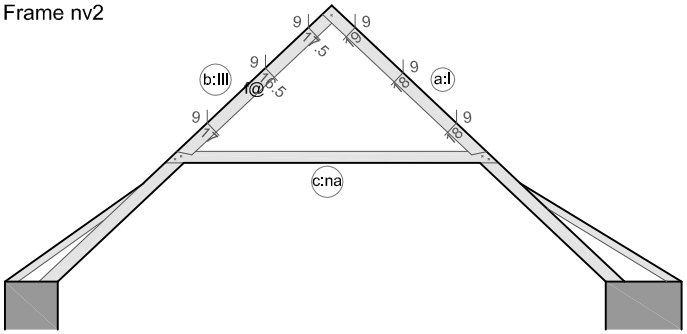
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

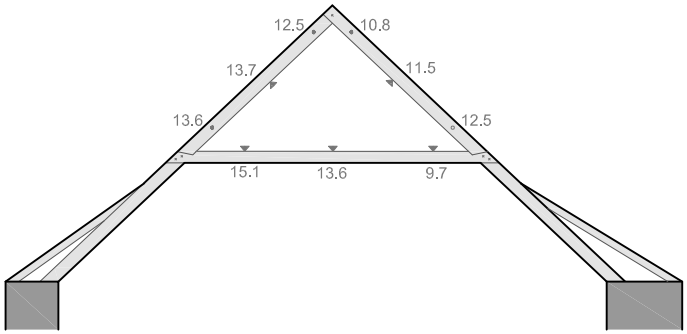
readings <18
readings >18
readings >20

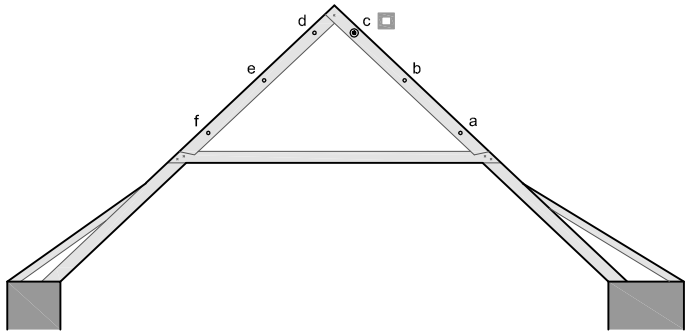
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- Internal decay
- ext. & int. decay
- extensive decay

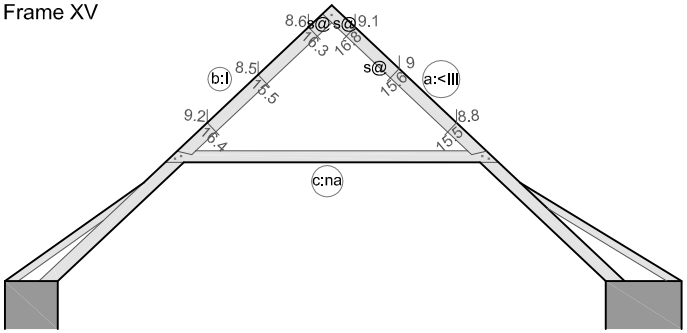
Frame nv2

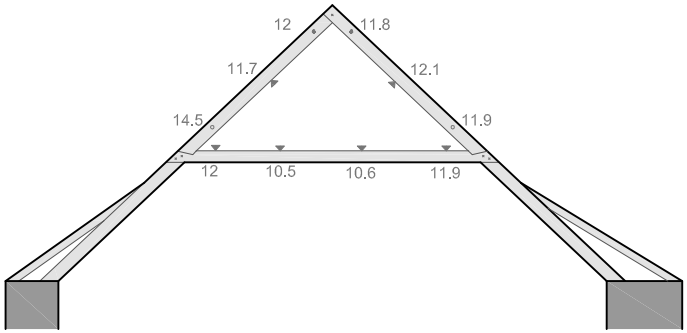


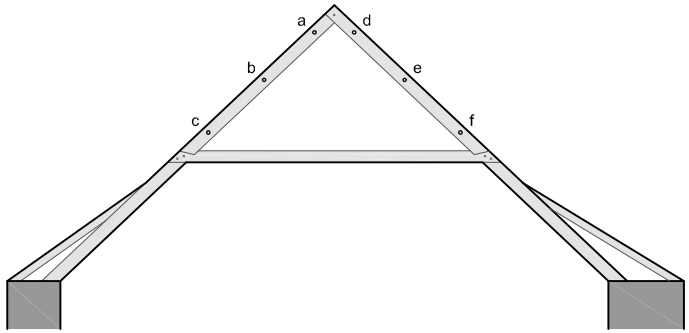




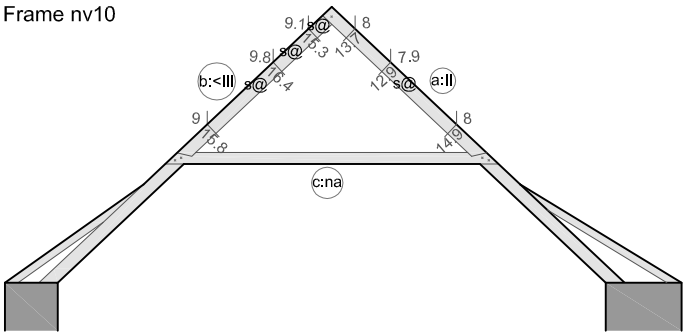
Frame XV

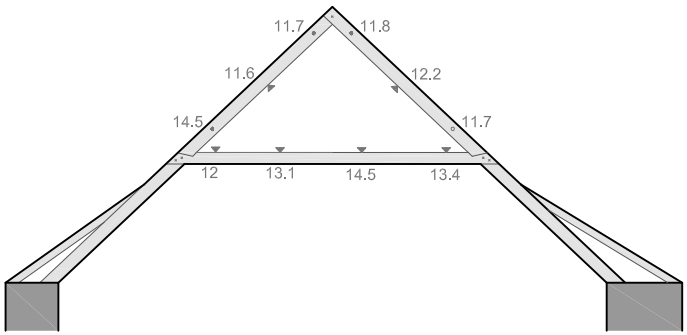


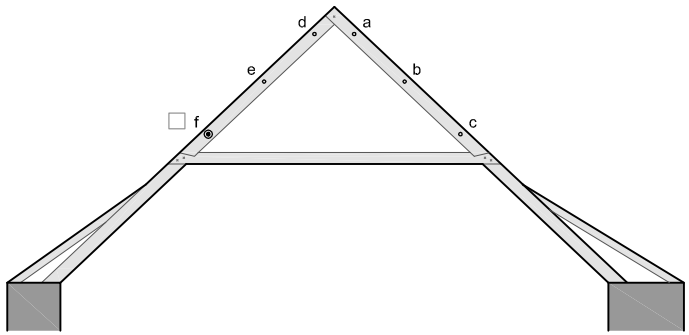




Frame nv10







Building Name: Stirling Castle Palace | Roof Location: SW range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou

Drawing SCP-SW-4 | PhD thesis | Architecture Department, University of Strathclyde

1001

Sections 1:100 (looking East)

Visual inspection:

- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- (x) element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

Moisture content readings:

- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

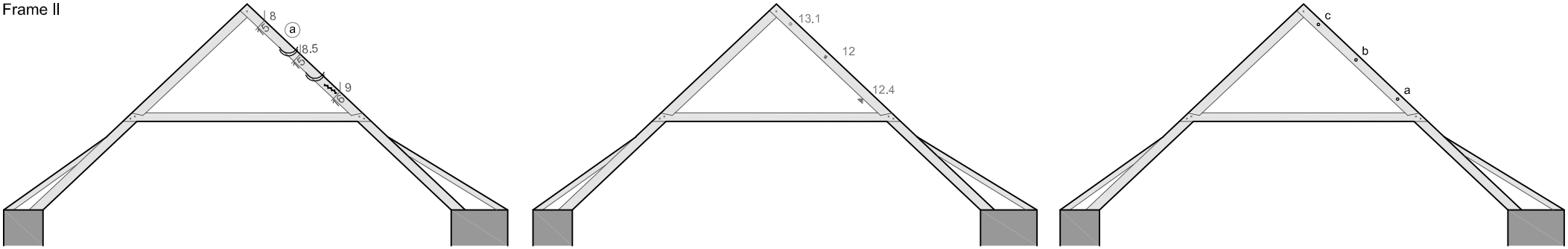
Ultrasound measurements:

- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

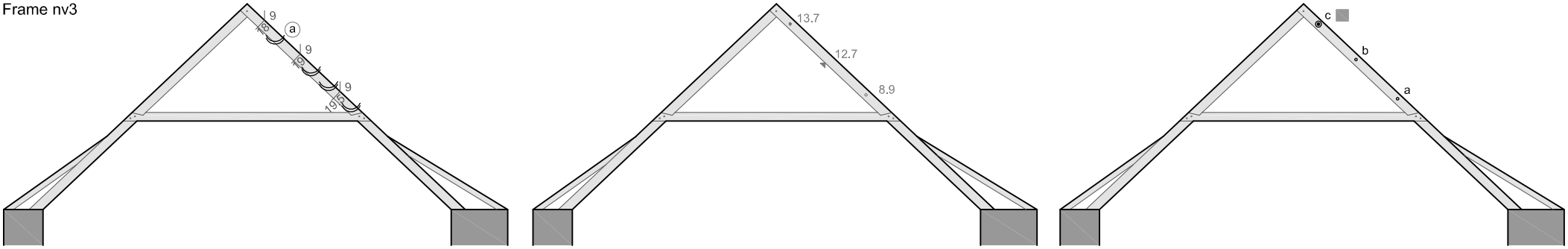
Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements

- good
- external decay
- internal decay
- ext. & int. decay
- extensive decay

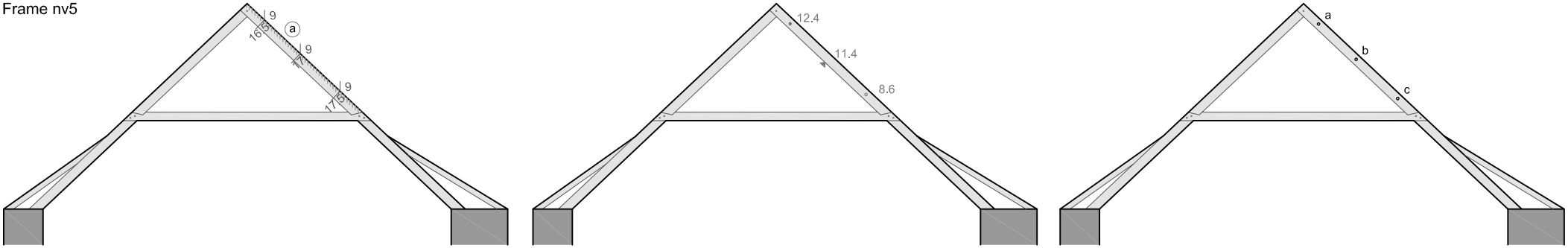
Frame II



Frame nv3



Frame nv5



Building Name: Stirling Castle Palace | Roof Location: SW range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou

Drawing SCP-SW-5 | PhD thesis | Architecture Department, University of Strathclyde

1002

Sections 1:100 (looking East)

Visual inspection:

- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- (x) element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

Moisture content readings:

- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20

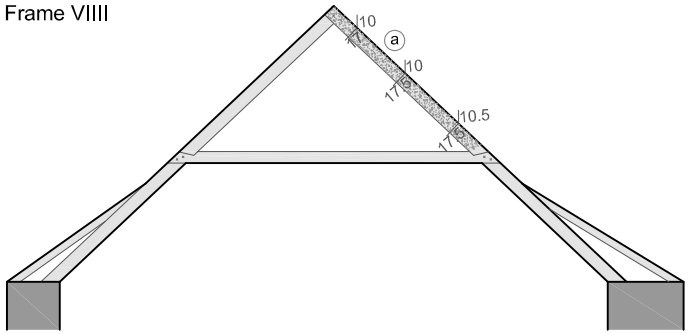
Ultrasound measurements:

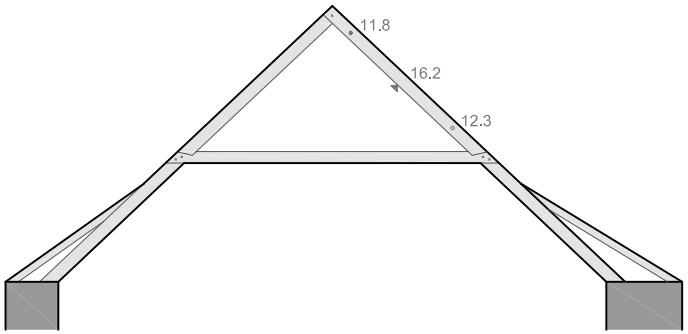
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

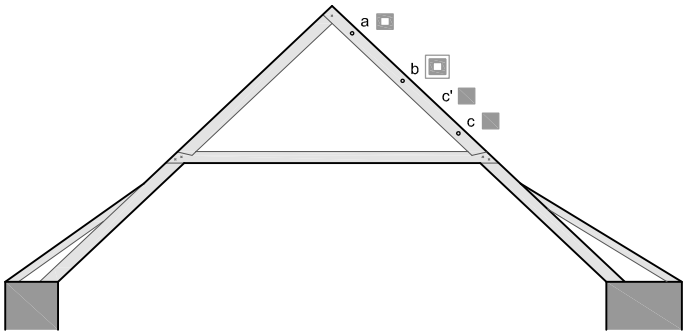
Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements

- good
- external decay
- Internal decay
- ext. & int. decay
- extensive decay

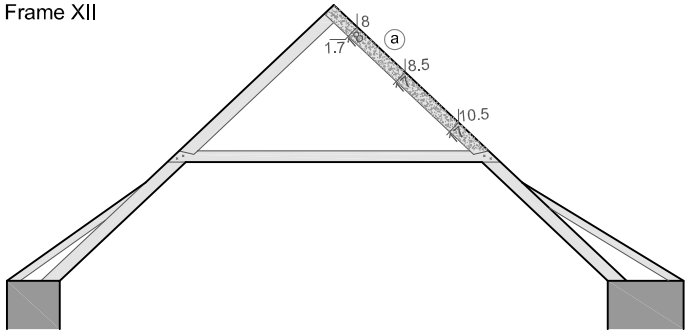
Frame VIIII

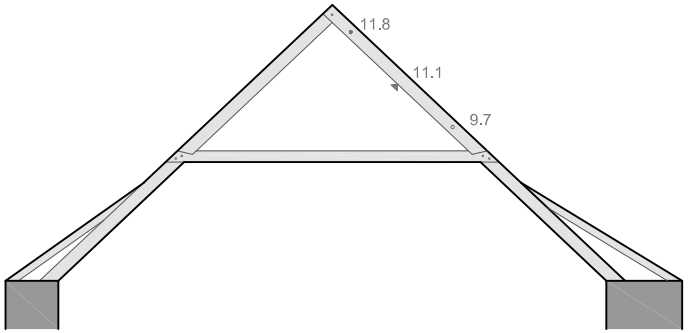


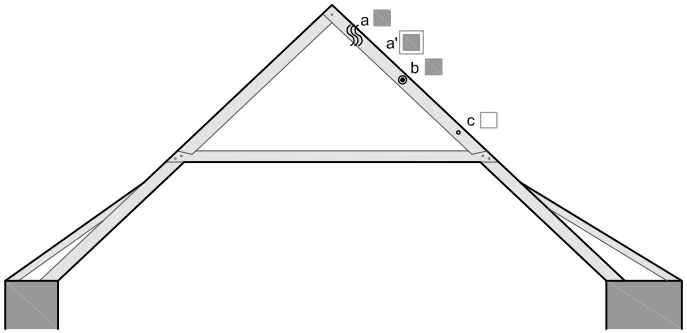




Frame XII







DETAILED SURVEY **Building name** STIRLING CASTLE_PALACE **Roof location** 2: NE range

Survey date(s) 10/02/2016 07/04/2016 29/04/2016 16/06/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SCP-NE-1, SCP-NE-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafters	580	rectangular	bending, compression	pinus sylvestris	3 hand axed faces and 1 hand sawn
Upper collars	370	rectangular	bending, compression	pinus sylvestris	3 hand axed faces and 1 hand sawn
Lower collars	670	rectangular	bending, tension		the visible face is hand axed
Struts	167	rectangular	compression, tension	pinus sylvestris	3 hand axed faces and 1 hand sawn
Sprocket rafters		rectangular	bending, compression		
Sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

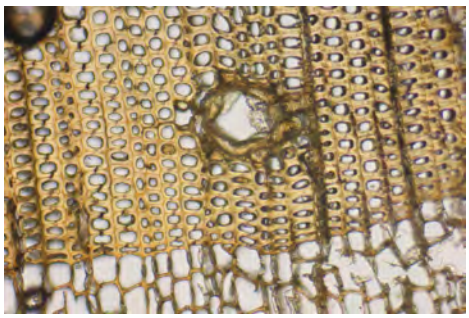
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SCP-NE-1, SCP-NE-2

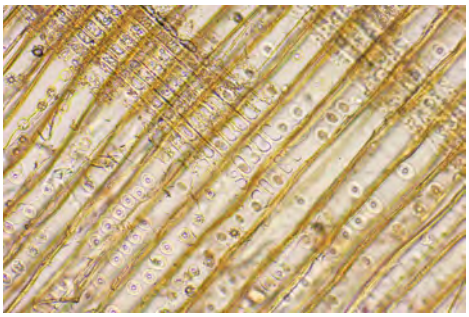
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter	Corner halved	compression	nails	
rafter & upper collar	Encounter dovetail	compression	nails	
rafter & lower collar	Encounter dovetail	compression, tension	nails	
strut & collar	Encounter dovetail	compression, tension	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

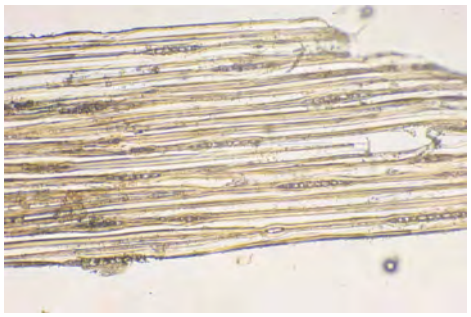
Microscopic identification of the timber species See drawing SCP-NE-2



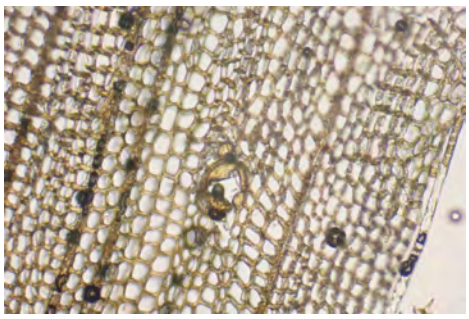
Rafter: transv. Section x100 I:\Arc



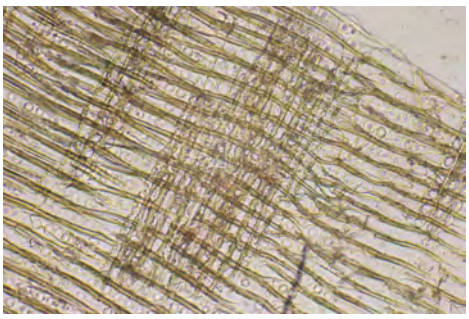
Rafter: radial section x100 I:\Arc



Rafter: trang. section x50 I:\Arc



Sarking: transv. Section x100 I:\Arc



Sarking: radial section x100 I:\Arc



Sarking: tang. Section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing SCP-NE-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	centre	10/02/2016	10 am	13	67.2

roof space	centre	10/02/2016	10 am	12	67.2
roof space	centre	29/04/2016	10 am	17	61
roof space	centre	16/06/2016	10 am	18.6	63.8

Frame/Truss name not visible 9 — See drawing SCP-NE-2

Missing elements | Elements with defects in critical area: upper collar

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other: big shake in collar

Frame/Truss name III — See drawing SCP-NE-4

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack: south rafter

Failed joints | Fungi attack

Other

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 17.2x9.9 | min. size (hxb) [cm]: 16.9x9.7 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: active | Way of identification: Estimated

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: external decay of 2.5cm maximum and internal decay of 0.5cm maximum

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

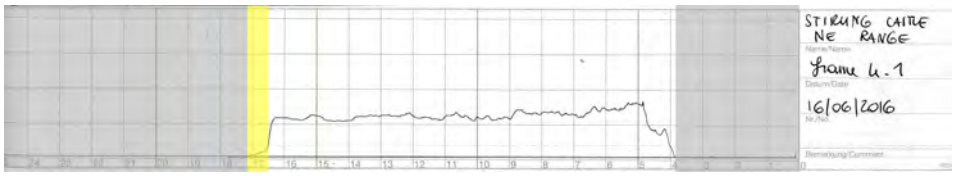
Moisture Content [%]: 15.8 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1089 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: 10.1

Material Degradation based on Micro-drill [%]: 4.6

Link to Micro-drill graph: I:\Arc

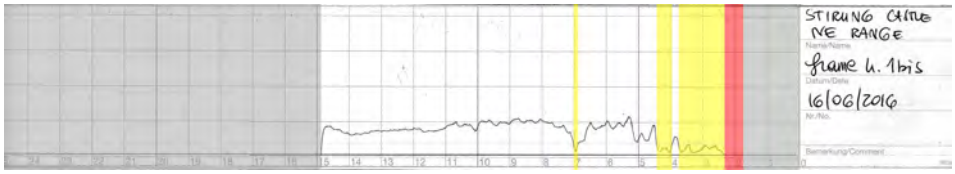


LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point a'

Moisture Content [%]
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%] 16.8
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

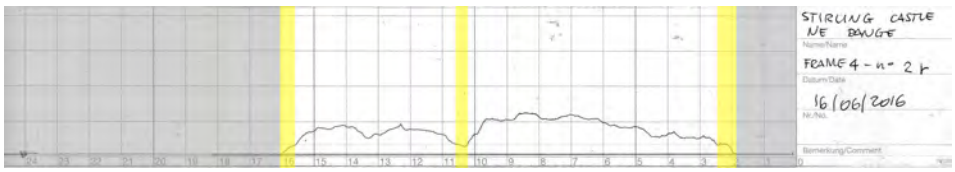


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 17
Ultrasonic velocity [m/s] 1231
Density loss based on ultrasonic test [%] 4.5
Material Degradation based on Micro-drill [%] 7.6
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

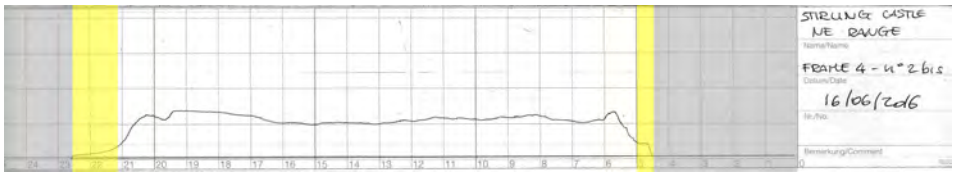


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b'

Moisture Content [%]
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%] 9
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☑

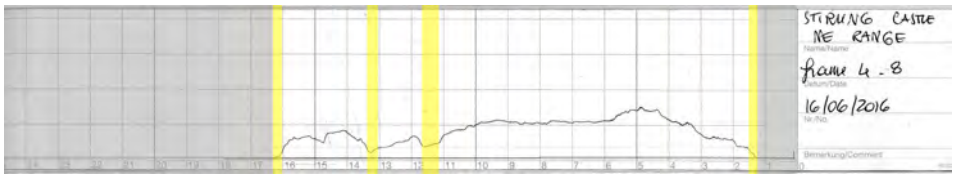


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 15.2
Ultrasonic velocity [m/s] 1069
Density loss based on ultrasonic test [%] 10.9
Material Degradation based on Micro-drill [%] 7.6
Link to Micro-drill graph I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☑ Higher gain ☑ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name non visible 7 See drawing SCP-NE-4

Missing elements
Elements with defects in critical area
Joints with decayed peg
Insect attack north rafter & south rafter
Failed joints
Fungi attack
Other

Element name A north rafter

Dating original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 16x9 min. size (hxb) [cm] 16x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side
Slope of grain [%]
Knots [min d/section h]
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



insect attack | I:\Arc

Material degradation

Insect attack ☑ Type: Anobium Punctatum | Status: active | Way of identification: Estimated

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: very limited external decay | Way of identification: NDT/SDT

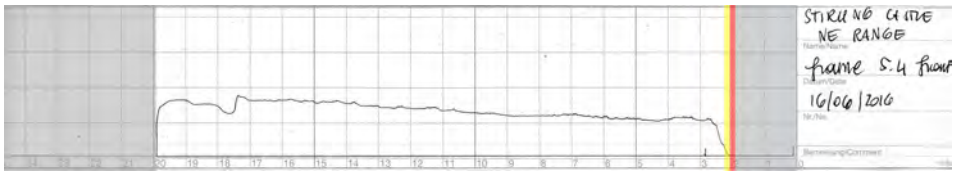
Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 21.2
Ultrasonic velocity [m/s]: 2273
Density loss based on ultrasonic test [%]: -36.8
Material Degradation based on Micro-drill [%]: 1.9
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

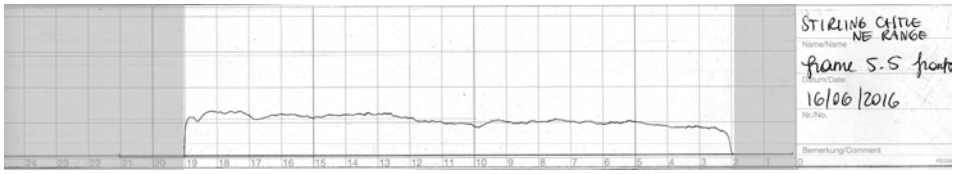


LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 18.4
Ultrasonic velocity [m/s]: 2185
Density loss based on ultrasonic test [%]: -33.3
Material Degradation based on Micro-drill [%]: 0
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%]
Ultrasonic velocity [m/s]
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph

Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name B south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Past interventions | Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 17.5x9 | min. size (hxb) [cm]: 17x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☑ Type: Anobium Punctatum Status: active
Way of identification: Estimated

Fungi attack ☐ Type: Status:
Way of identification:

Corrosion ☐ Wet surface ☐ Other:



insect attack I:\Arc

Mechanical Damage

Type		Status	Role
Deformation ☐			
Cracks ☐			
Crushing ☐			
Other ☐			

Estimated level of damage: Emergency interv. needed ☐

Mater.Degr. and Damage Extent: very limited external decay

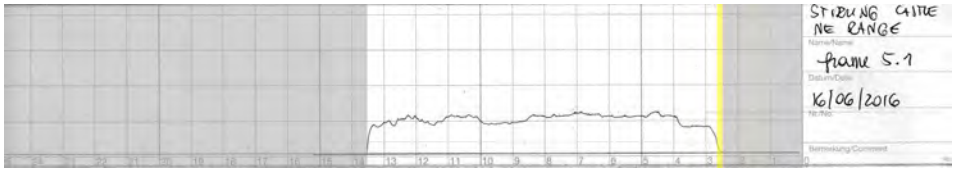
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 15
Ultrasonic velocity [m/s]: 1989
Density loss based on ultrasonic test [%]: -25.5
Material Degradation based on Micro-drill [%]: 1.4
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

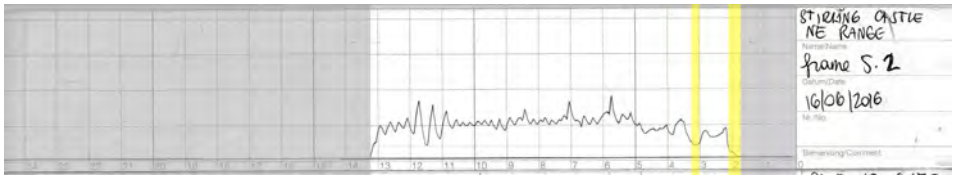


LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 16.6
Ultrasonic velocity [m/s]: 2041
Density loss based on ultrasonic test [%]: -27.6
Material Degradation based on Micro-drill [%]: 4.4
Link to Micro-drill graph: I:\Arc

Visible Material Degradation ☑ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 16.8
Ultrasonic velocity [m/s]: 1855
Density loss based on ultrasonic test [%]: -20.2
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name /\ See drawing SCP-NE-4

Missing elements: Elements with defects in critical area:
Joints with decayed peg: Insect attack: strut
Failed joints: Fungi attack:
Other:

Element name A strut

Dating: original construction Signs of reuse:

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.7x2.7 | min. size (hxb) [cm] 11.5x2.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



insect attack | I:\Arc

Material degradation

Insect attack ☑ | Type Anobium Punctatum | Status active | Way of identification Estimated

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: external decay up to 2cm | Way of identification: visual inspection

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%] 18.1 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%] 18.3 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc | Low resistance | High resistance (knot | Out of timber

Frame/Truss name IIII | See drawing SCP-NE-2

Missing elements strut | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints | Fungi attack

Other

Frame/Truss name VI | See drawing SCP-NE-5

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack north rafter

Failed joints | Fungi attack

Other

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 17.1x10.2 | min. size (hxb) [cm]: 16.5x10 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



insect attack | I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: active

Way of identification: Estimated

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: max 1cm external decay

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

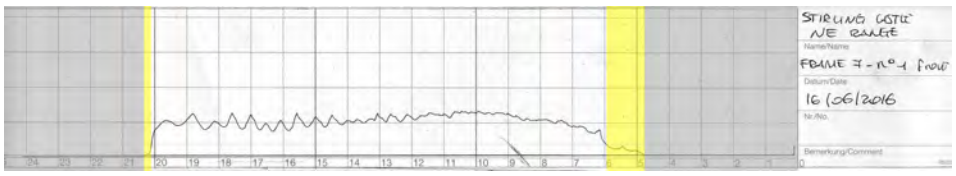
Moisture Content [%]: 15.5 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1542 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -7.8

Material Degradation based on Micro-drill [%]: 7.7

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

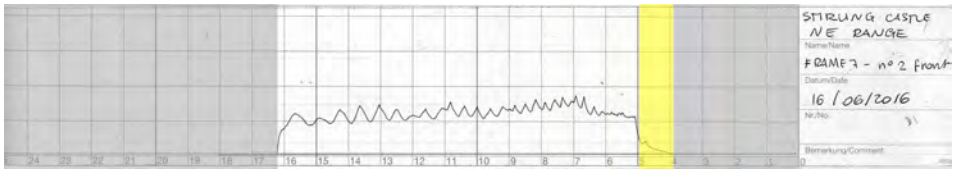
Moisture Content [%]: 16.5 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1958 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -24.3

Material Degradation based on Micro-drill [%]: 7.5

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%] 16.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1689 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -13.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1516 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -6.8

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name non visible 3 See drawing SCP-NE-5

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack north rafter

Failed joints | Fungi attack

Other

Element name A north rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 16.5x9.7 min. size (hxb) [cm] 16.1x9.3 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other



insect attack I:\Arc

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: maximum 1.5cm external decay

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

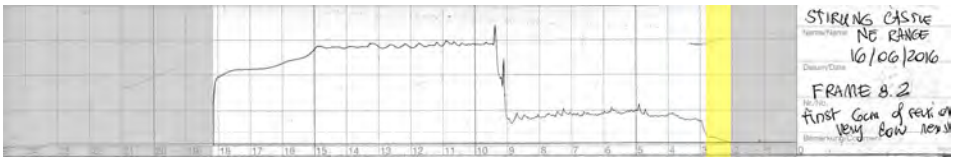
Degradation ☐ Poor maintenance ☐

Past interv. ☐

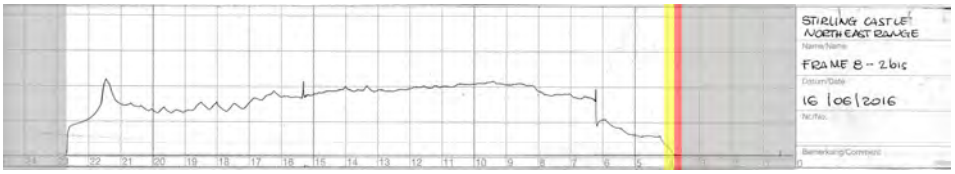
External actions ☐

Other ☐

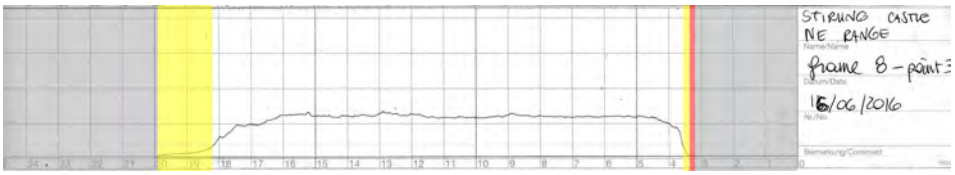
Measurement Point a

Moisture Content [%]	16.9	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1491	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-5.8					
Material Degradation based on Micro-drill [%]	4.8					
Link to Micro-drill graph	I:\Arc					
LEGEND		Zero resistanc	Low resistance	High resistance (knot	Out of timber	

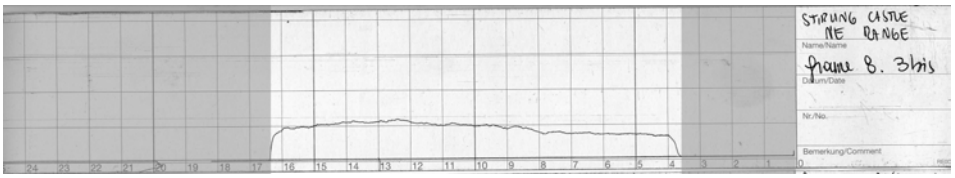
Measurement Point a'

Moisture Content [%]		Visible Material Degradation ☑	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]						
Material Degradation based on Micro-drill [%]	2.6					
Link to Micro-drill graph	I:\Arc					
LEGEND		Zero resistanc	Low resistance	High resistance (knot	Out of timber	

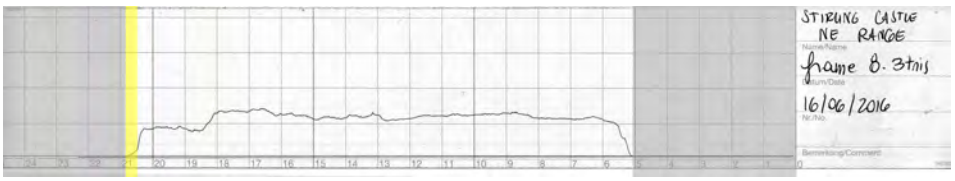
Measurement Point b

Moisture Content [%]	17.9	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1548	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-8					
Material Degradation based on Micro-drill [%]	11.4					
Link to Micro-drill graph	I:\Arc					
LEGEND		Zero resistanc	Low resistance	High resistance (knot	Out of timber	

Measurement Point b'

Moisture Content [%]		Visible Material Degradation ☑	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]						
Material Degradation based on Micro-drill [%]	0					
Link to Micro-drill graph	I:\Arc					
LEGEND		Zero resistanc	Low resistance	High resistance (knot	Out of timber	

Measurement Point b''

Moisture Content [%]		Visible Material Degradation ☑	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]						
Material Degradation based on Micro-drill [%]	2.4					
Link to Micro-drill graph	I:\Arc					
LEGEND		Zero resistanc	Low resistance	High resistance (knot	Out of timber	

Measurement Point c

Moisture Content [%]		Visible Material Degradation ☑	Not Accessible for: hygrometer ☑	ultrasonic ☑	micro-drill ☑	
Ultrasonic velocity [m/s]		Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]						
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						
LEGEND		Zero resistanc	Low resistance	High resistance (knot	Out of timber	

Measurement Point d

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1586 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -9.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name non visible 1 See drawing SCP-NE-5

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other next to wet gable

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.5x9.2 min. size (hxb) [cm] 17x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119



wet gable next to rafter I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other next to wet gable

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1889 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -21.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 16.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1506 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -6.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name non visible 10 See drawing SCP-NE-3

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack upper collar

Failed joints Fungi attack

Other

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17x10 min. size (hxb) [cm] 16x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 3/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]	15.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1652	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-12.2					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]	16.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1720	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-14.8					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]	15.8	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1632	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-11.4					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north rafter

Dating: original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]: 17.5x10 min. size (hxb) [cm]: 17x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 2 tangential
Knots [min d/section h]: 2/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects: shake near centre centre
Estimated Strength Class according to UNI 11119: III

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role



shake near centre I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]	17.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1509	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-6.5					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]	17	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1637	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-11.6					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]	16.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1417	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-2.9					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C upper collar

Dating: original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm]: 16.5x7.5 min. size (hxb) [cm]: 16x7.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 2 tangential
Knots [min d/section h]: 3.5/7.5 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119: III

Material degradation

Insect attack ☑ Type: Anobium Punctatum Status: active
Way of identification: Estimated
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role



insect attack near centre I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: very limited external decay

Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

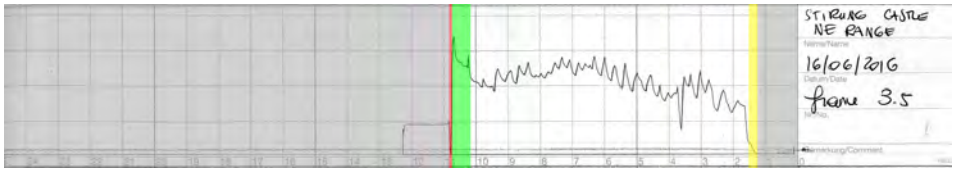
Measurement Point a

Moisture Content [%]	15.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	2326	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-38.9					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]	15.5	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1760	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-16.4					
Material Degradation based on Micro-drill [%]	3.8					
Link to Micro-drill graph	I:\Arc					



LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]	15.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	ultrasonic ☐	micro-drill ☐	
Ultrasonic velocity [m/s]	1687	Higher voltage ☐	Higher gain ☐	Signal not stable enough to take ultrasonic measur. ☐		
Density loss based on ultrasonic test [%]	-13.6					
Material Degradation based on Micro-drill [%]						
Link to Micro-drill graph						

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name D lower collar

Dating: original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues: only one face partly visible because wrapped in plastic sheet

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 10.8x9.8 min. size (hxb) [cm]: 10.5x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location
Slope of grain [%]
Knots [min d/section h]
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%] 15.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 15.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 14.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 14.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name E strut

Dating original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 15x3.7 min. size (hxb) [cm] 15x3 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential
Knots [min d/section h] 3/15 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 17.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 21.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name XI See drawing SCP-NE-3

Missing elements Elements with defects in critical area upper collar, north rafter

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 18x9.8 min. size (hxb) [cm] 18x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage
Way of identification: NDT/SDT

Measurement Point a

Moisture Content [%]: 15
Ultrasonic velocity [m/s]: 1513
Density loss based on ultrasonic test [%]: -6.7
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 15.5
Ultrasonic velocity [m/s]: 1410
Density loss based on ultrasonic test [%]: -2.6
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 14.7
Ultrasonic velocity [m/s]: 1431
Density loss based on ultrasonic test [%]: -3.4
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%]:
Ultrasonic velocity [m/s]:
Density loss based on ultrasonic test [%]:
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north rafter

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues:

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 17x9.8 | min. size (hxb) [cm]: 16x9.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 3 | tangential

Knots [min d/section h]: 3/9.5 | single | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: II



knot near centre on tension side | I:\Arc

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: max 1.5cm external decay

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 17.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 2128 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -31

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

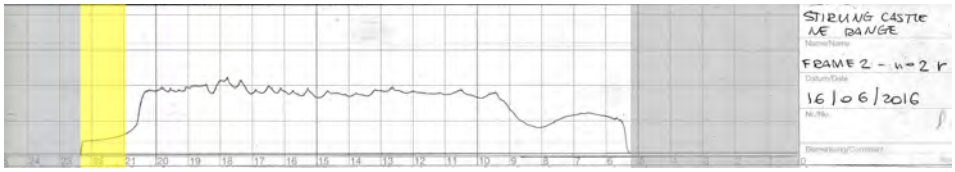
Moisture Content [%]: 18.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1884 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -21.3

Material Degradation based on Micro-drill [%]: 6

Link to Micro-drill graph: I:\Arc



LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%]: 16 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]: 1775 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -17

Material Degradation based on Micro-drill [%]:

Link to Micro-drill graph:

LEGEND: Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point d

Moisture Content [%] | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☑ | ultrasonic ☑ | micro-drill ☑

Ultrasonic velocity [m/s] | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Element name C upper collar

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 16x6.7 | min. size (hxb) [cm]: 16x6.5 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 16 | tangential

Knots [min d/section h]: 2.5/16.5 | single | Knotty element ☐ | Defects in critical area ☑ | Deep checks on both sides of element ☐

Other defects: shakes in central part

Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent: very limited external decay

Way of identification: NDT/SDT

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

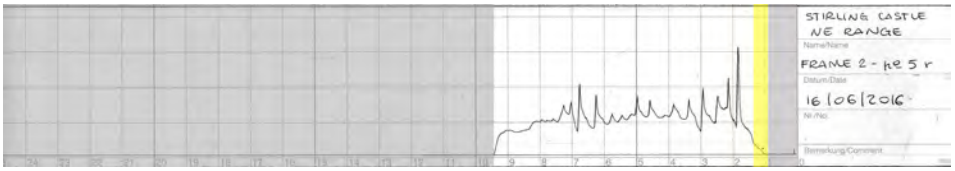
Moisture Content [%]: 17 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s]: 1334 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: 0.4

Material Degradation based on Micro-drill [%]: 4.6

Link to Micro-drill graph: I:\Arc



LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point b

Moisture Content [%]: 14.3 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐ | ultrasonic ☐ | micro-drill ☐

Ultrasonic velocity [m/s]: 1703 | Higher voltage ☐ | Higher gain ☐ | Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]: -14.2

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND | Zero resistanc | Low resistance | High resistance (knot | Out of timber

Measurement Point c

Moisture Content [%] 16.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1580 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -9.3

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues only one face partly visible because wrapped in plastic sheet

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 10.1x9.6 min. size (hxb) [cm] 10x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location Slope of grain [%]

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 14.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 14.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 13.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 16.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name E strut

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 15x2.7 min. size (hxb) [cm] 15x2.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 9 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Measurement Point a

Moisture Content [%] 19.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 20.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Frame/Truss name II See drawing SCP-NE-3

Missing elements Elements with defects in critical area upper collar

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other cracks in upper collar and north rafter

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 17.5x9.8 min. size (hxb) [cm] 17x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: NDT/SDT

Measurement Point a

Moisture Content [%] 15.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1508 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -6.5

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1582 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -9.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 15.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1557 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -8.4

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 15.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1521 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -7

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 18x9.5 min. size (hxb) [cm] 18x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 5.5/9.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects shake close to top

Estimated Strength Class according to UNI 11119 lower than III



shakes and knot in upper part I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type		Status	Role
Deformation ☐			
Cracks ☑		unknown	unknown
Crushing ☐			
Other ☐			

Estimated level of damage initial Emergency interv. needed ☐

Mater.Degr. and Damage Extent No decay/damage

Way of identification NDT/SDT

Estimated causes of primary damage

Poor design ☐

Poor construct. ☑ poor material quality

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1663 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -12.6

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 15.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1539 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] -7.7

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑ ultrasonic ☑ micro-drill ☑

Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

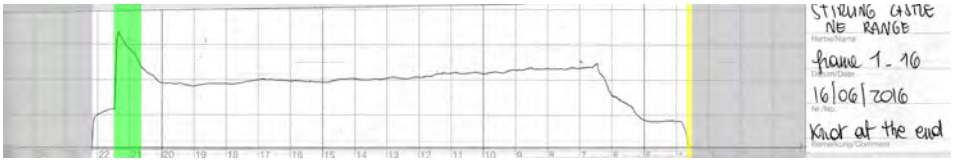
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s] 1295 Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%] 1.9



Material Degradation based on Micro-drill [%] 1

Link to Micro-drill graph I:\Arc

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name C upper collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 18x7.5 min. size (hxb) [cm] 18x7.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 7 radial

Knots [min d/section h] 4/7.5 single Knotty element ☐ Defects in critical area ☑ Deep checks on both sides of element ☐

Other defects shakes near the centre

Estimated Strength Class according to UNI 11119 lower than III



Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

shakes near the centre I:\Arc

Deformation ☐
Cracks ☑ unknown unknown
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage
Way of identification: NDT/SDT

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]: 16.1
Ultrasonic velocity [m/s]: 1647
Density loss based on ultrasonic test [%]: -12
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 15.3
Ultrasonic velocity [m/s]: 1614
Density loss based on ultrasonic test [%]: -10.7
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%]: 14.6
Ultrasonic velocity [m/s]: 1610
Density loss based on ultrasonic test [%]: -10.5
Material Degradation based on Micro-drill [%]:
Link to Micro-drill graph:

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐
Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name D lower collar

Dating: original construction
Signs of reuse:
Timber treated ☐
Past interventions:
Accessibilityissues: only one face partly visible because wrapped in plastic sheet

Differences compared to other elements of the same type:
Section: nominal size (hxb) [cm]: 10.1x9.8 min. size (hxb) [cm]: 10x9.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location:
Slope of grain [%]:
Knots [min d/section h]:
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects:
Estimated Strength Class according to UNI 11119:

Material degradation

Insect attack ☐ Type: Status:
Way of identification:
Fungi attack ☐ Type: Status:
Way of identification:
Corrosion ☐ Wet surface ☐ Other:

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%] 12.6 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point c

Moisture Content [%] 13.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point d

Moisture Content [%] 14 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☑ micro-drill ☑
Ultrasonic velocity [m/s] Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐
Density loss based on ultrasonic test [%]
Material Degradation based on Micro-drill [%]
Link to Micro-drill graph
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Element name E strut

Dating original construction
Signs of reuse
Timber treated ☐
Accessibilityissues
Past interventions
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 15x2.5 min. size (hxb) [cm] 15x2.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 10 tangential
Knots [min d/section h]
Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type		Status	Role
Deformation	☐		
Cracks	☐		
Crushing	☐		
Other	☐		

Estimated level of damage

Emergency interv. needed ☐

Mater.Degr. and Damage Extent: No decay/damage

Way of identification: visual inspection

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%]: 17.2

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

Link to Micro-drill graph

LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Measurement Point b

Moisture Content [%]: 17

Visible Material Degradation ☐ Not Accessible for: hygrometer ☐ ultrasonic ☐ micro-drill ☐

Ultrasonic velocity [m/s]

Higher voltage ☐ Higher gain ☐ Signal not stable enough to take ultrasonic measur. ☐

Density loss based on ultrasonic test [%]

Material Degradation based on Micro-drill [%]

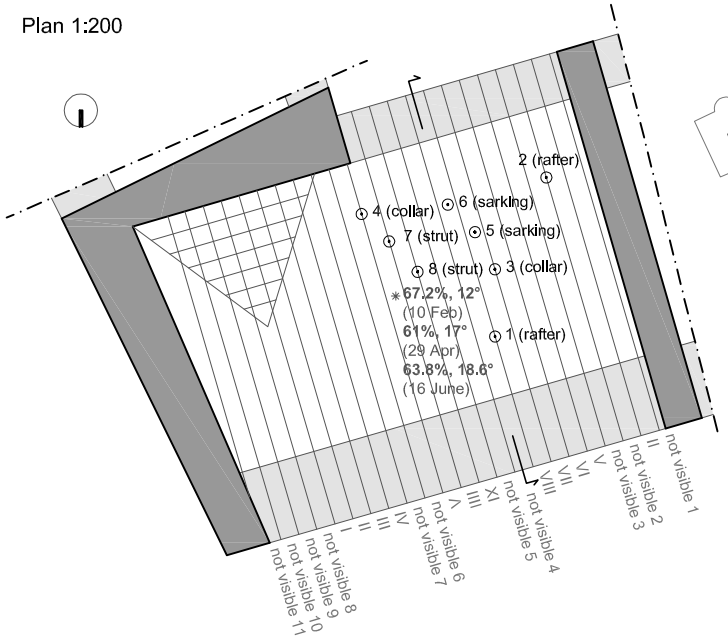
Link to Micro-drill graph

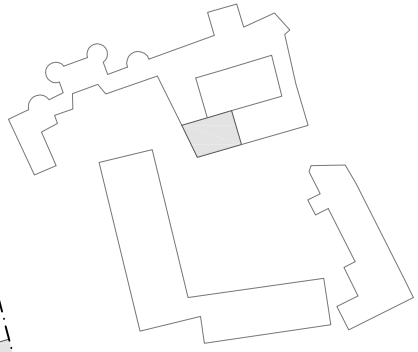
LEGEND Zero resistanc Low resistance High resistance (knot Out of timber

Building Name: Stirling Castle Palace | Roof Location: NE range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou
Drawing SCP-NE-2 | PhD thesis | Architecture Department, University of Strathclyde

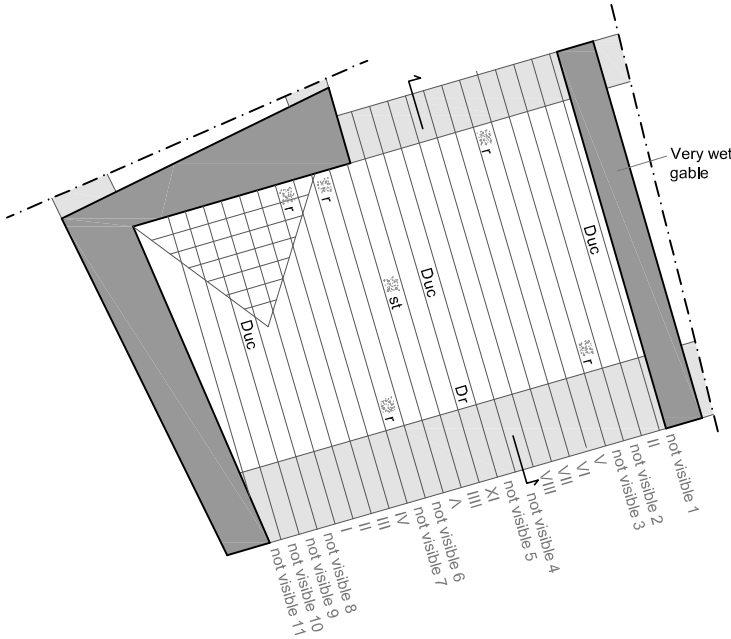
1030

Plan 1:200





air humidity and temperature
timber samples for species identification



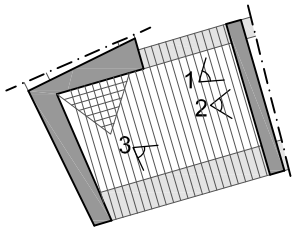
Visual Inspection:
r=rafter
uc=upper collar
st=strut

wound (injury to living tree)
D element with defects in critical area
crack
element rotation
failed joint
decayed peg in joint
wet surface
efflorescence
insect attack
fungi attack

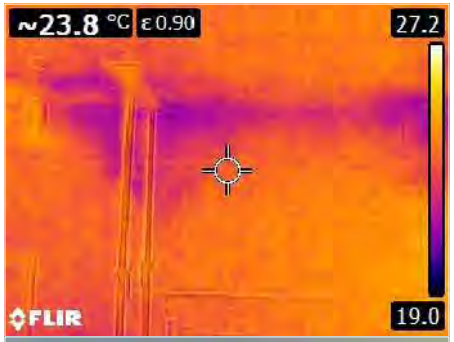
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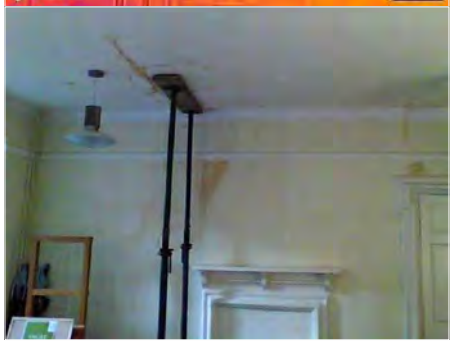
Themographic images

Plan 1:500

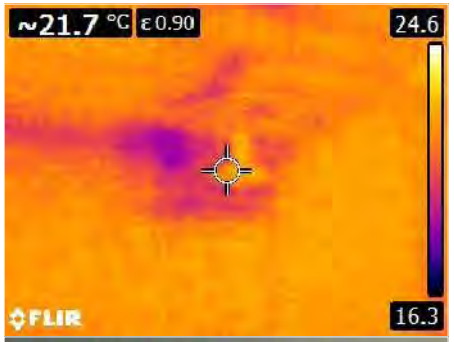


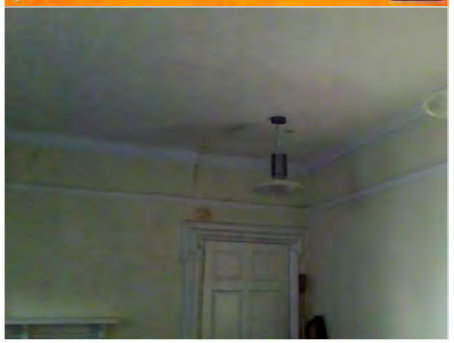
1: areas with lower temperature identify patches of humidity close to the West gable





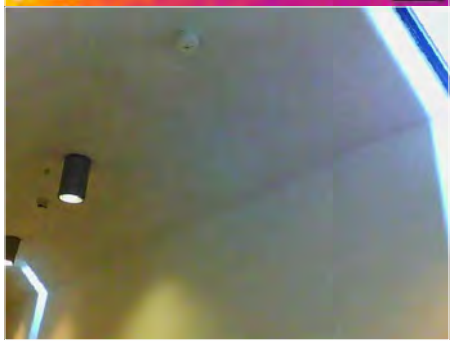
2: areas with lower temperature identify patches of humidity close to the West gable





3: areas with higher temperature show the position of the rafters behind the plaster in the attic spaces - the rafters are very well visible probably because insulation sheets are missing in between them





Sections 1:100 (looking West)

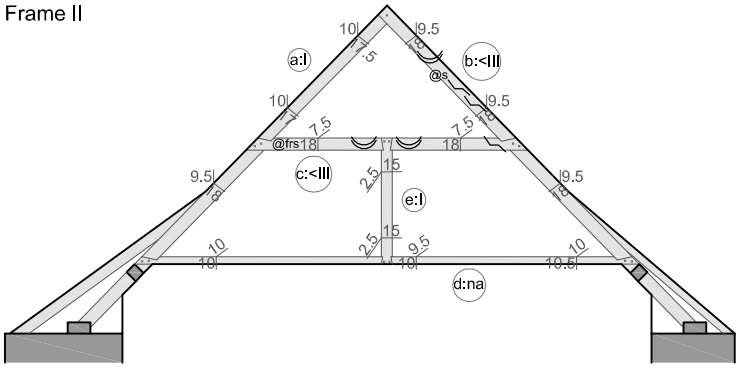
Visual inspection:
- higly inclined slope of grain
- @ big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

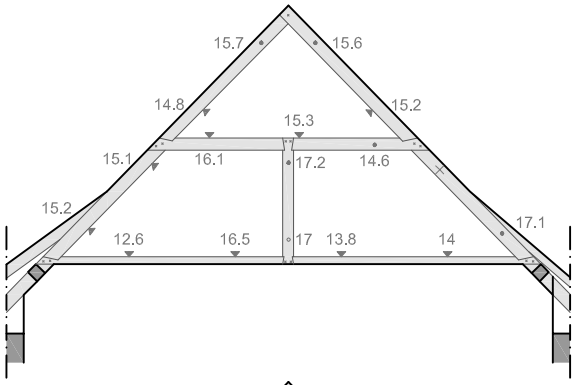
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible
- readings <18
- *readings >18*
- **readings >20**

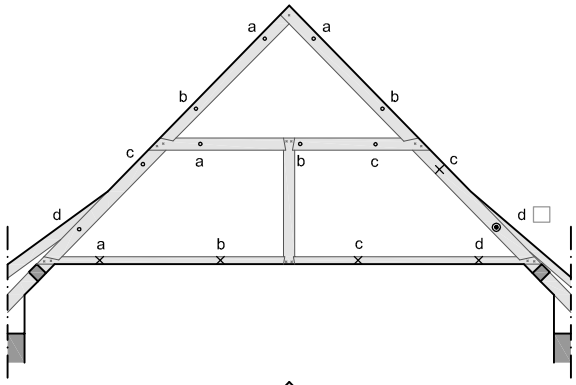
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- Internal decay
- ext. & int. decay
- extensive decay

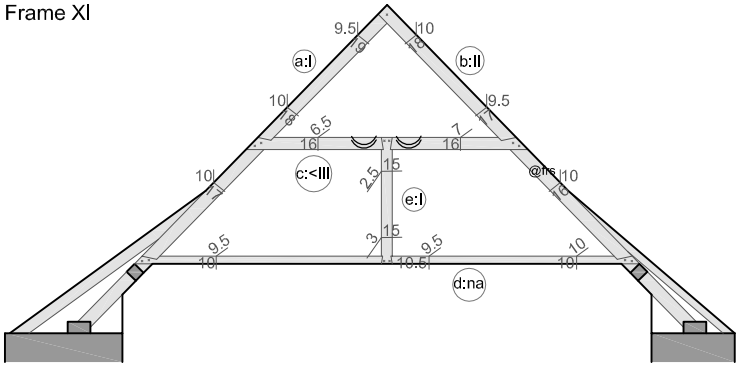
Frame II

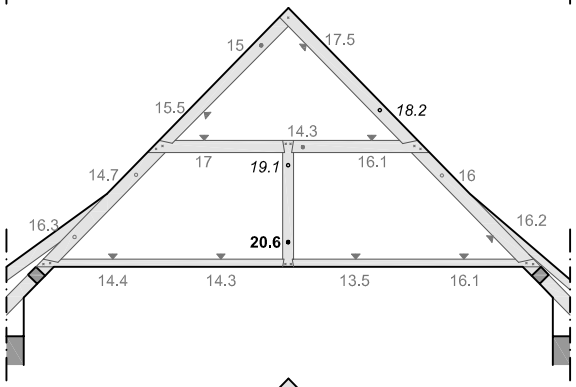


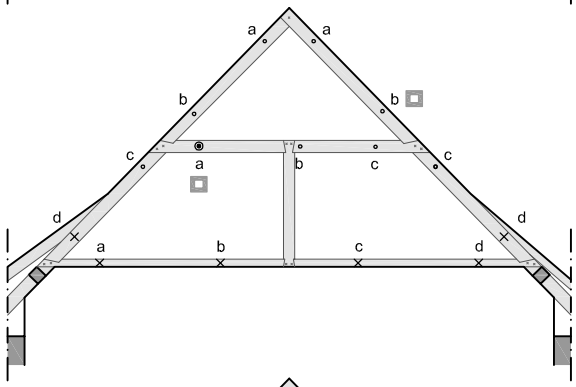




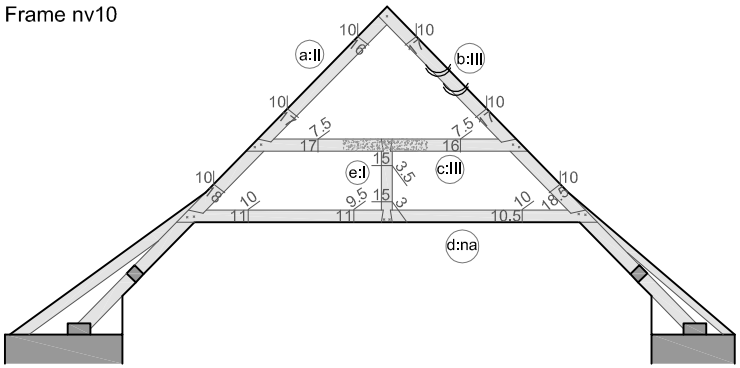
Frame XI

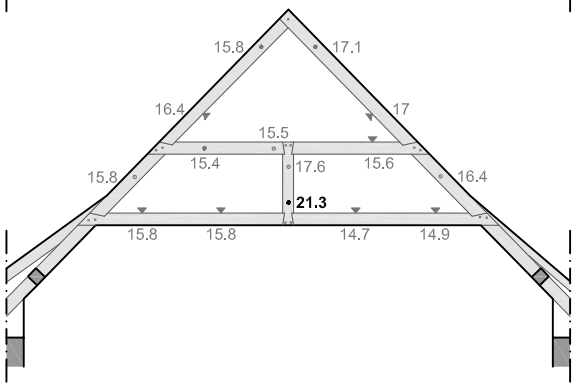


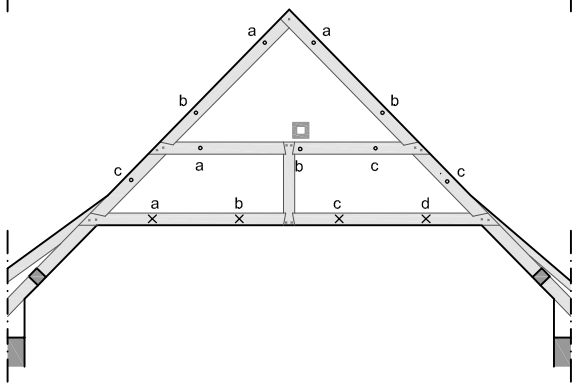




Frame nv10







Building Name: Stirling Castle Palace | Roof Location: NE range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou
Drawing SCP-NE-4 | PhD thesis | Architecture Department, University of Strathclyde

Sections 1:100 (looking West)

Visual inspection:
- higly inclined slope of grain
- big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

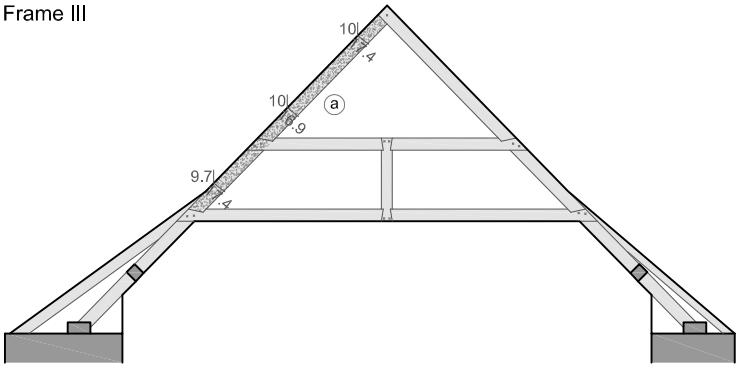
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

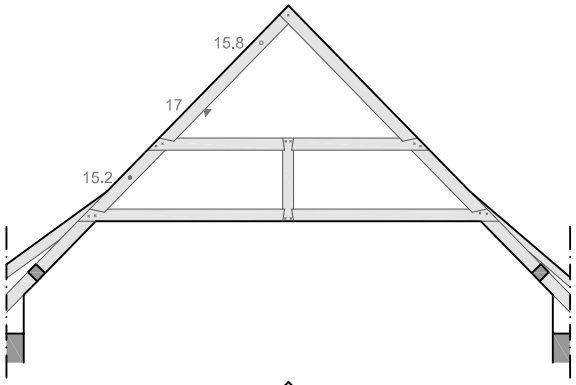
readings <18
readings >18
readings >20

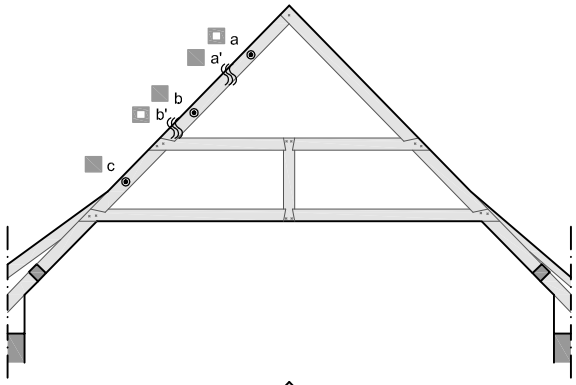
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
- Internal decay
- ext. & int. decay
- extensive decay

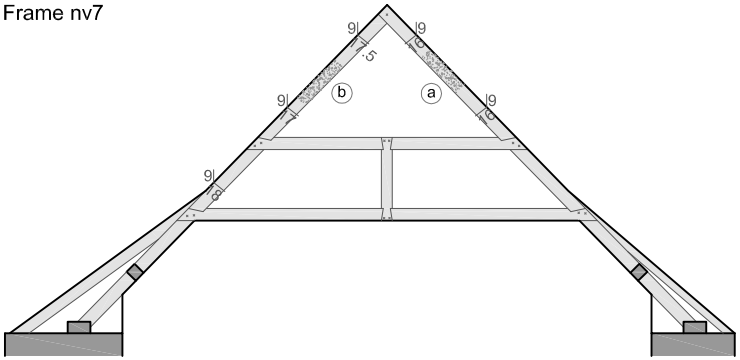
Frame III

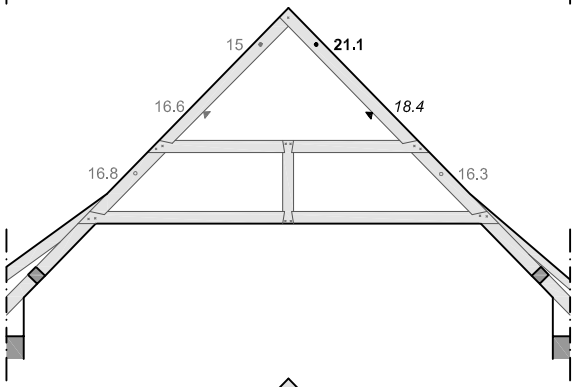


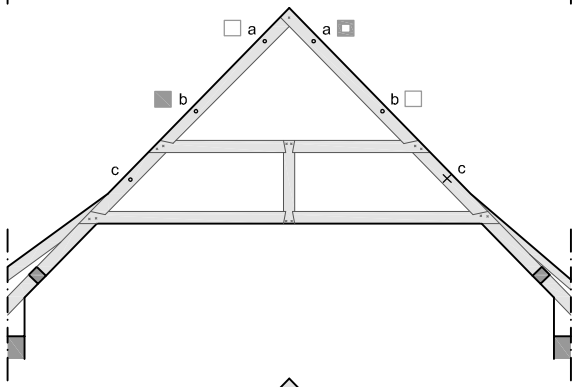




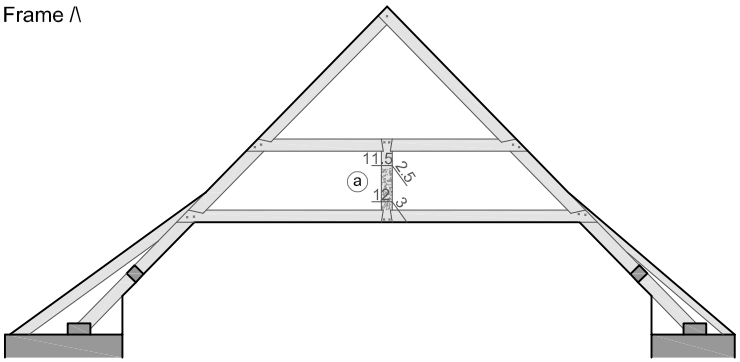
Frame nv7

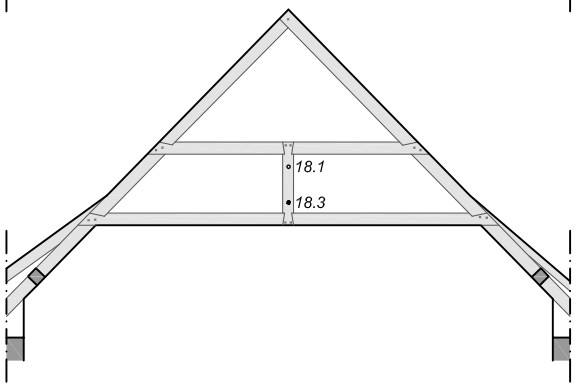


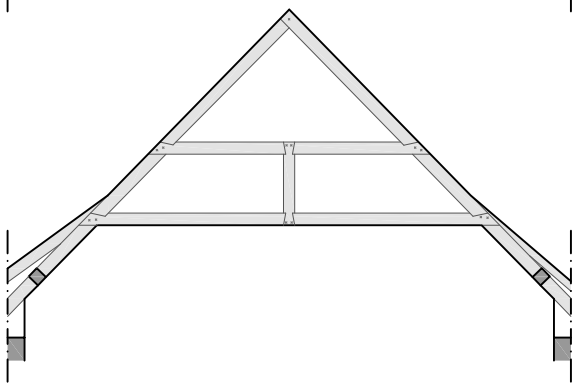




Frame /\







Building Name: Stirling Castle Palace | Roof Location: NE range | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou
Drawing SCP-NE-5 | PhD thesis | Architecture Department, University of Strathclyde

Sections 1:100 (looking West)

Visual inspection:
- higly inclined slope of grain
- big knots (f=front, r=rear, s=sides)
- checks on both sides
- shake
- wound (injury to living tree)
- crack
- element rotation
- open joint
- element name
- wet surface
- efflorescence
- decayed peg
- insect attack
- fungi attack

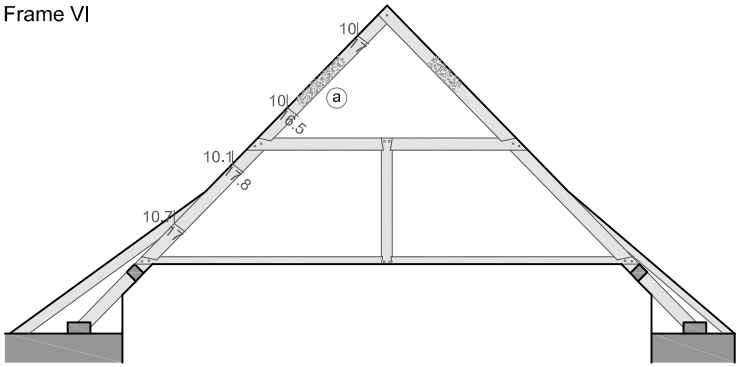
Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

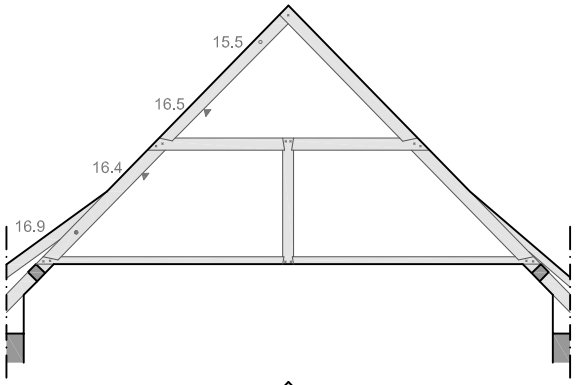
readings <18
readings >18
readings >20

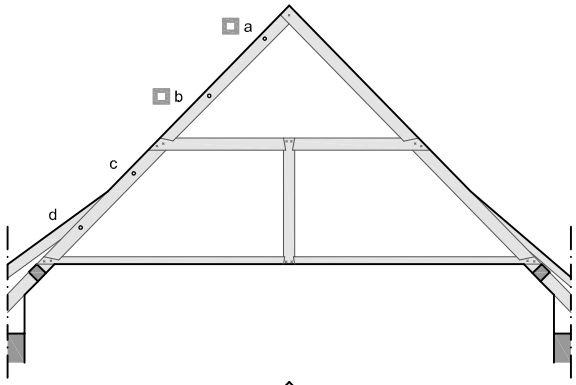
Ultrasound measurements:
- good velocity [+ higher voltage, ++higher voltage and gain]
- low velocity
- 2 faces not accessible
- signal not stable

Resistograph drills: where there is visible decay, high moisture content or low velocity/unstable signal in ultrasonic measurements
- good
- external decay
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- ext. & int. decay
- extensive decay

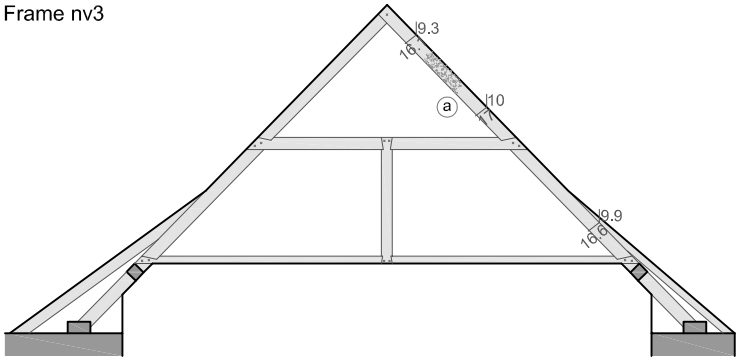
Frame VI

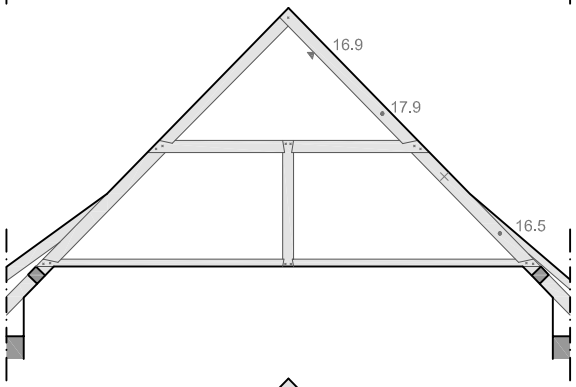


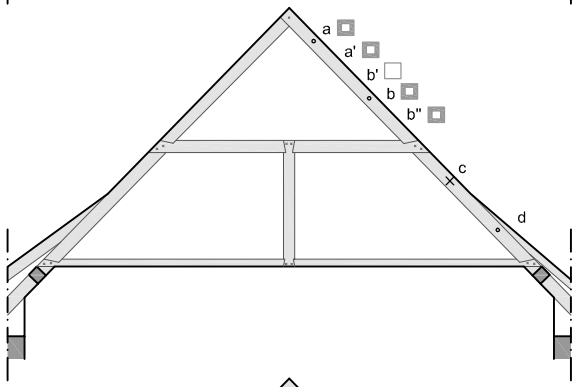




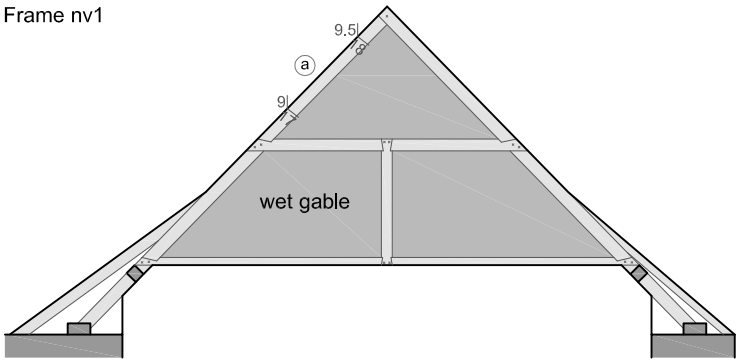
Frame nv3

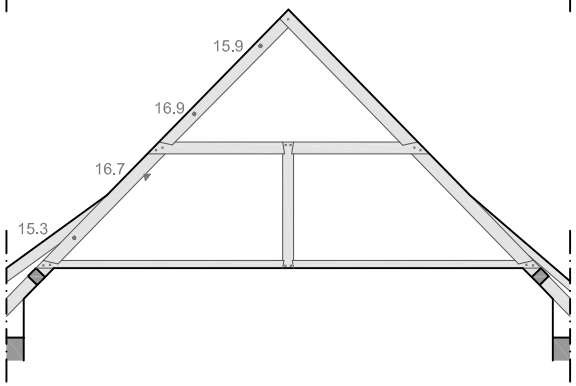


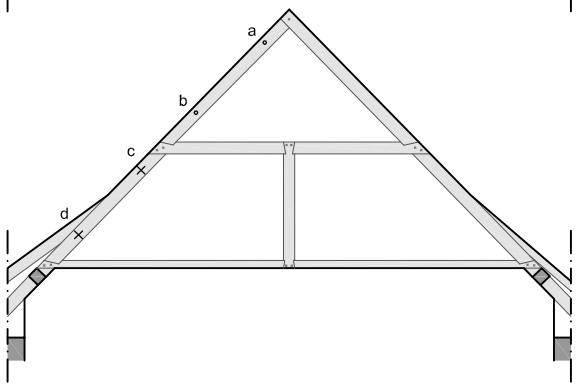


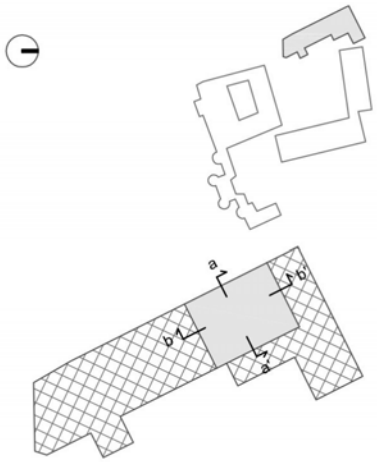


Frame nv1





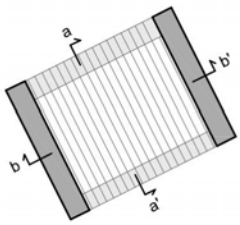




Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Carpentry marks from south to north:

XX/I
XXXIIII
XXX/IIII
XXXII
XXIX
II
XXX
I/X
XXXI
X/II
X/IIII
XVII
XX
XXI
ΛIII
XXIII
not visible
not visible

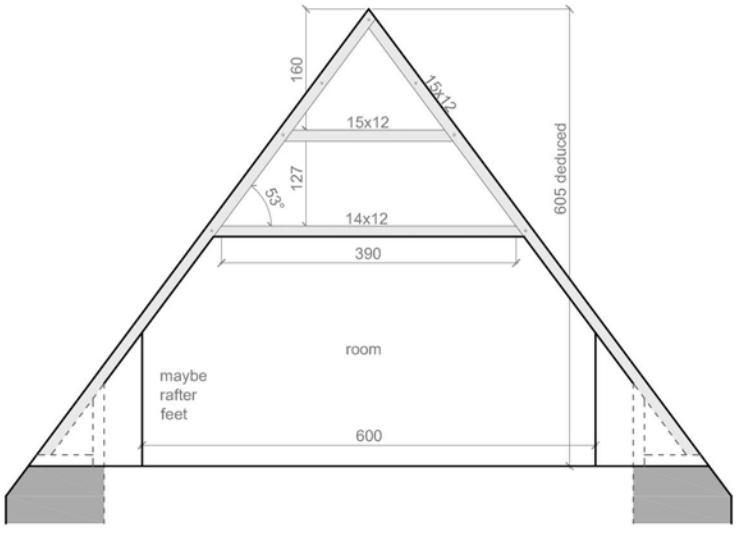
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

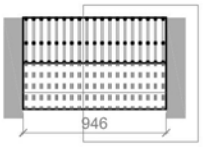
Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

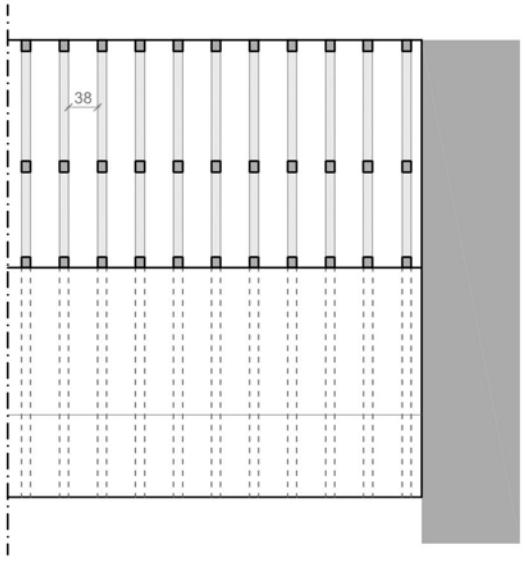
Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section aa'



Section bb'





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b



INITIAL SURVEY | **Building name** STIRLING CASTLE_THE KING'S OLD BUILDINGS | **Roof location** N block next to NE wing

Survey date(s) 01/10/2014 | See drawing: SCKOB-N-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 7 | Roof Height [m]: 6.05

Roof Pitch/es [°]: 53 | Roof Length [m]: 9.46

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.4

Type of Secondary Structure: sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Unknown

Connection with gables:

Roof Construction Period: From 1557 To | Identified by: Estimated

Roof General Description: Gabled roof with 18 frames with 2 collars each. Connection with wall not visible. Rafters composed of 2 timbers with scarf joint.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 15 B: 12 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed) | Bark ☐

Joint Types: mortice and tenon, scarf

Fasteners Types: Metal nail, Timber peg not flush

Joints description: All mortice and tenon with timber pegs not flush. The rafters are made of 2 elements and have plain scarf joints with iron nails.

Wood Species: oak | Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals

Carpentry Marks Description: Not in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Joints: rafters | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☑ Insulation on ceiling ☑ Insulation on sarking ☑

Decorative features

Unfavourable conditions: presence of water tank

Accessibility limitations: Connection with wall not visible

Past interventions: Insulation and water tank added. Some rafters reinforced with timber.



Past interventions link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☐ Diffuse insect exit holes ☐

	Damage Type:	Damage Status:	Damage Role:	
Roof Damage				link
Unit Damage				
Element Damage				
Connection Damage				

Estimated cause(s) of the primary damage: link

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage link

Other Notes: Building presumably constructed in 1557. In 19C all roofs replaced after fire damage, besides this part that was surveyed. The roof typology, joints and numerals could point to the beginning of 17C, rather than mid 16C, but the scarf joints in the rafters are quite unique.

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs key bui link

DETAILED SURVEY **Building name** STIRLING CASTLE_THE KING'S OLD BUILDINGS **Roof location** N block next to NE win

Survey date(s) 10/02/2016 07/04/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings SCKOB-N-1, SCKOB-N-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
Rafters	750	square	bending, compression	quercus sp.	hand axed
Upper collars	200	square	bending, compression	quercus sp.	hand axed
Lower collars	390	square	bending, compression		hand axed
Sarking		sheet	bending, tension		

* estimated based on drawings because not fully accessible

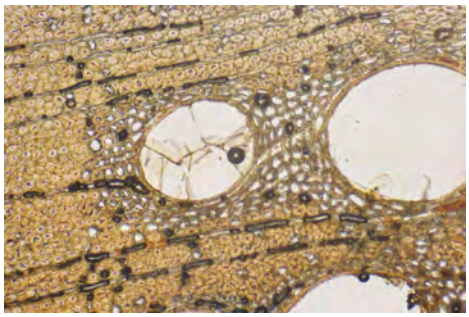
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings SCKOB-N-1, SCKOB-N-2

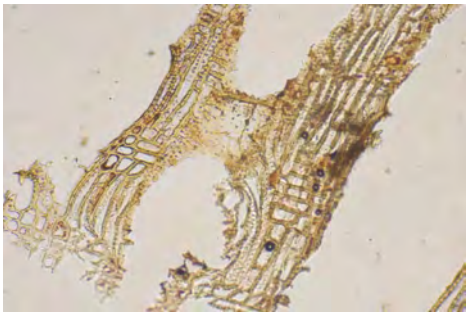
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter (same element)	Scarf halved	shear	nails	
rafter & rafter	Corner mortice & tenon	compression	wooden pegs	
rafter & collar	Encounter mortice & tenon	compression	wooden pegs	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

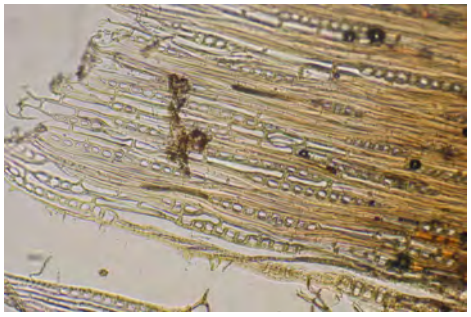
Microscopic identification of the timber species See drawing SCKOB-N-2



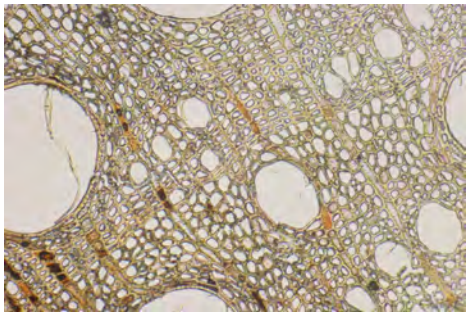
Rafter: transv. Section x100 I:\Arc



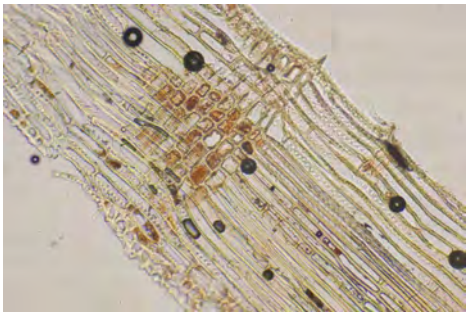
Rafter: radial section x100 I:\Arc



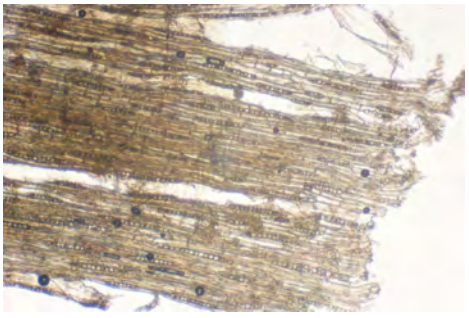
Rafter: trang. Section x100 I:\Arc



Upper collar: transv. Section x100 I:\Arc



Upper collar: radial section x100 I:\Arc

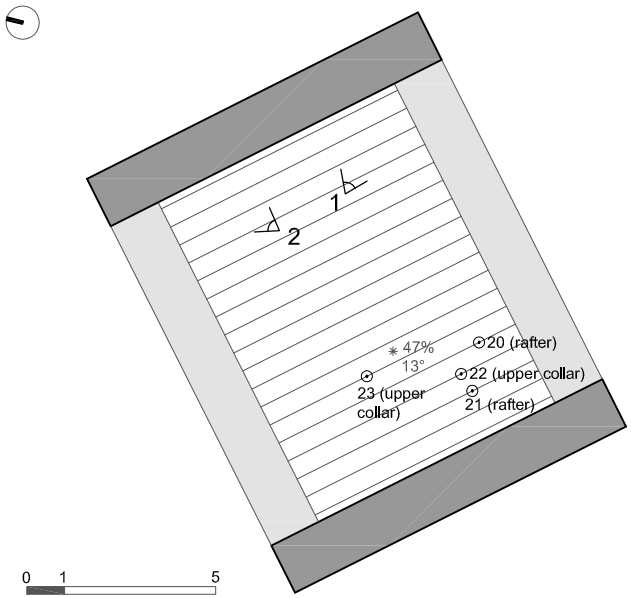


Upper collar: trang. Section x50 I:\Arc

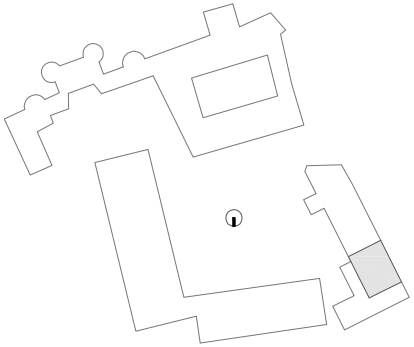
Air Temperature and Relative Humidity measurements See drawing SCKOB-N-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	N side	10/02/2016	12:45 am	16	47

Plan 1:200



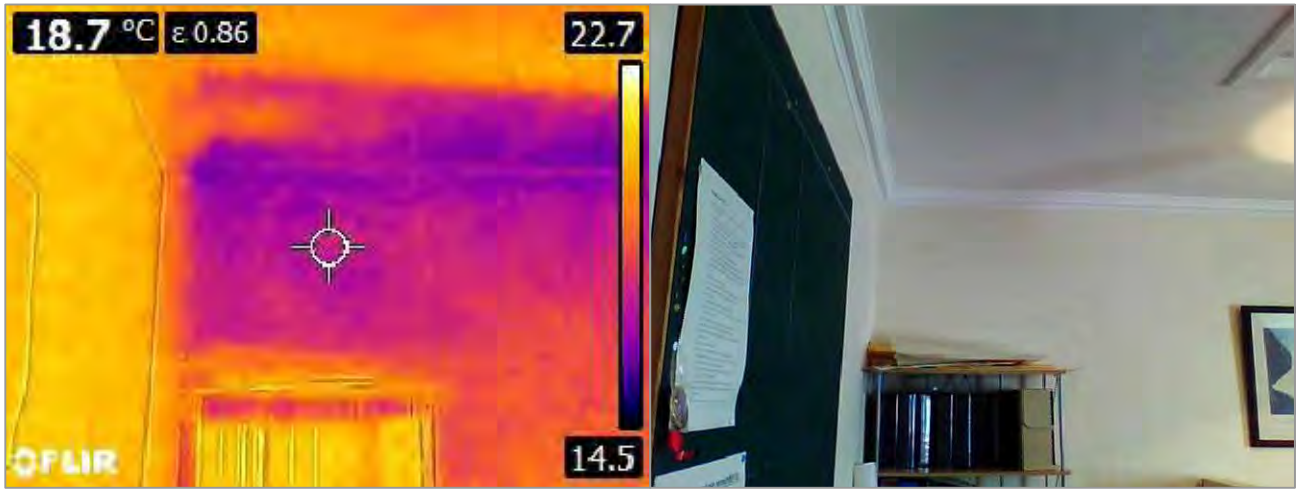
- air humidity and temperature
- timber samples for species identification
- thermographic images



1: areas with lower temperature on the left identify a patch of humidity close to the North-East gable



2: areas with lower temperature on the left identify a patch of humidity close to the North-East gable



TOUCH HOUSE

Location STIRLING | ST NINIANS

X coordinate 275328 Y coordinate 692755

Geogr. Referencing System BRITISH NATIONAL GRID





Property status PRIVATE

Rcahms ID 46238

HS Listing A

Original Use Residential

Current Use Residential

Freestanding ☑ N. of floors above ground level 3 Location link I:\Arch\AD Building picture link I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1500	1599	Z PLAN TOWER HOUSE - TODAY ONLY SE TOWER AND LOWER PORTION OF NW TOWER REMAIN	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1600	1699	NW TOWER REBUILT AND EXTENDED EAST (TODAY NORTH RANGE)	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1757	1762	MAIN BLOCK OF THE ORIGINAL BUILDING REPLACED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☑
STEINSON	JAMES	ARCHITECT	☑
GRAY	GIDEON	CONTRACTOR, MASON	☐
CLAYTON	THOMAS	PLASTERER	☐
PATERSON	GEORGE	WRIGHT	☐
GIBSON	HENRY	WRIGHT	☐
SETON	HUGH (SMITH)	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1800	1899	RANGE OF OFFICES AT THE NE ANGLE	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1810		ELLIPTICAL STAIRS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
GILLESPIE GRAHAM	JAMES	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1927	1930	RENOVATION OF INTERIORS, STRENGTHENING OF MAIN BLOCK ROOF AND REPLACEMENT OF NORTHEAST ROOF OF NORTH RANGE - POSSIBLY REPAIRS IN NORTHWEST ROOF OF NORTH RANGE AS WELL	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
LORIMER	SIR ROBERT	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR, DAMAGE	1968		CUPOLA FELL OFF DURING STORM - IT WAS REPLACED AND ROOF STRENGTHENED	OWNER

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2013		FOUND DRY ROT IN A CORNER OF THE ROOF - IT WAS REPAIRED WITH TIMBER AND STEEL	OWNER

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	405
GIFFORD J.	2002	☐	THE BUILDINGS OF SCOTLAND COLLECTION: STIRLING AND CENTRAL	

ARCHIVAL REFERENCES

Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	Account of materials				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	Letter from timber merchant to Mr Seton				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	transcription of account of timber				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	account of timber				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	Account for haulage from Stirling dock to Touch by James Danskin				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	account				
Archive	RCAHMS	Doc.Num.	LOR/T/1/5	Folios	
Title	Plans, sections and elevations of verandah, repairs to North wing roof and coal cellar. Plans and sections of new drive and forecourt				

Suggestions for further research

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: Account of materials | Date: from | to

Contents:
[…]
13 roods of scleatting @ 4£ 10sh per rood £58 – 10 – 0
468 yards of roofing and sarking @ 5sh a yard £117 – 0 – 0
592 feet of sheet lead for flanks & etc @ 18d £44 – 8 – 0
[…]

Summary and comments: Not dated but according to A. Mackechnie it could be late 17C. Not sure what 'roofing' implies, but this is not enough to be the construction of the roof on the old range. It's probably repairs and resarking only.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: Letter from timber merchant to Mr Seton | Date: from 1751 | to

Contents:
Dundee 27 September 1751
Mr. Setton,
Sir
I send you inclosed an Account of Wood bought from me by Mr. Geo. Paterson, Wright in Edinburgh, for your use and to your account which receive from the Bearer. I delivered the Wood here to Henry Gibson, one of Mr. Geo. Patersons foreman who ordered the logs to be cut out for your use as ordered by the by said Mr. Geo. Paterson his Master.
Please write me on Receipt of this, if it be convenient to pay the within account in Edinburgh, and where I shall call for it, or if it be more convenient for you, to pay the same at Alloa to James Kirk, Merchant thee, whose Receipt for the same shall be sufficiently good as my own, either of which is agreeable to,
Sir,
Your most obedient servant,
Ja. Key
[…]

Summary and comments: Letter from timber merchant to Mr Seton with account of timber bought by George Paterson, who must be the wright in charge of the timber works, and maybe more. The logs are brought on the construction site and cut there.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: account | Date: from 1757 | to

Contents:
Mr Robert Leckie for Hugh Seaton of Touch Esqr. To William Brown
1757
[…]
October 3 To livering 4 hundred 10 single sardish? Deals 110 ballons? and 30 sawn logs 3sh
To shoardues? As for 6 hundred deals @ 10p hund. 5sh
To waiting on timber altnight? one man 6d
[…]
To freight and port charges of timber ??? 2£ 11sh 4d
To man for waiting on timber all night 8d

Summary and comments:

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: account of timber | Date: from 1757 | to

Contents:
Hugh Seton Esqr. Of Touch
Bo't of Haig Deas & Co.
1757
Nov. 9 2 Copenhagen Logs measr. 59 ½ foot [18.7m] *@ 14d 3 – 9 – 5*
Cutting 6 Draught @ 8d 4
1758
April 4 26 Copenhagen Logs measr. 700 foot [219.8m] *@ 14d 40 – 16 – 8*
3 clean d.o for plank measr. 87 foot [27.3m] *@ d.o 5 – 1 – 6*
Cutting 96 draught @ 4 d 1 – 12 – 0
One barrel Stockholm Tar 1 – 5 – 0
April 18 11 Copenhagen Logs measr. 72 foot [22.6m] *@ 14 4 – 4 – 0*
Cutting 20 draught @ 4d 6 – 8
June 16 11 Copenhagen Logs measr. 362 ?? foot [113.6m] *@ 14 21 – 3 – 1*
One plank 3 inch thick [7.8cm] *12 foot* [3.8m] *long 2 – 6*

Cutting 24 Draught about 20 foot [6.28m] *long each @ 5d* *10 – 0*
Cutting 30 d.o @ 4d *10 – 0*
August 5 18 Riga Logs measr. 492 ?? foot [154.5m] *@ 14* *28 – 14 – 4*
August 19 Cutting 24 Draught each 23 foot [7.2m] *long @ 6d* *12 – 0*
Sept. 2 36 Riga Logs measured 1036 foot [325.3m] *@ 11* *60 – 8 – 8*
10 Norway 10&12 foot [3.2/3.8m] *Deals @ 11d and one hundred double flooring nails @ 12d for making affloat* *10 – 2*

£ 169 – 10 – 0
August 8 By your Draught on Charles Smith Esqr. *100 – 0 – 0*
Balance *69 – 10 – 0*

Alloa 21st November 1758 Received by the hands of Mr. Robert Leckie Payment of the above sum of Sixty nine Pounds Ten Shillings Sterling which is in full of all accounts. Haig Deas & Co.

Summary and comments: Account of wood bought for Mr Seton: Copenhagen (Norway) logs, Riga (Russia) logs, Norway deals and other small cuts. The Riga logs, being of higher quality, have probably been used for the purlins, whilst the Copenhagen logs have probably been used for the common rafters.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: transcription of account of timber | Date: from 1757 to

Contents:
Mr Setton of Touch by Mr Geo. Paterson
Bought off Jas Key, Dundee
1757
September 10th
To 30 Redwood scots pine Logs 9,209 Solid feet @ 9d. *10 – 2 - 4*
To 410 Best Superfine picked Gotenburg 1 ¼ Inch Deals @ 8£ p *32 – 13 – 4*
To Carriage paid to the Ship *5 – 0*
To Cash paid to Customhouse for a permit *2 – 0*
---
48 – 12 – 8

Summary and comments: Account of wood bought by George Paterson for Mr Seton: 30 scots pine logs and 410 high quality deals from Gotenburg (Sweden). This timber is probably for the roofs of the new house - the deals are sufficient to make the sarking of the central block, the logs could be for the common rafters.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: Account for haulage from Stirling dock to Touch by James Danskin | Date: from 1758 to

Contents:
James Danskin, Account for Haulage from Stirling dock to Touch
An account of money paid for Livering free Stones and Wood and Lead and Sclates for the use of Mr Seaton of Touch at the Shor of Stirling
1758
[…]
August 23 For taking out the float of wood paid 6sh
[…]
For taking care of wood lying at the Shor 2sh
[…]

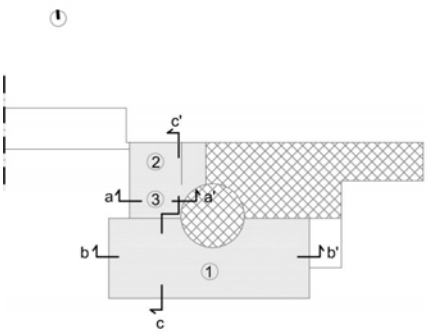
Summary and comments: Account of transport of materials to the house. No details on materials carried.

Archive: RCAHMS | Doc. Num.: LOR/T/1/5 | Folios:

Title: Plans, sections and elevations of verandah, repairs to North wing roof and coal cellar. Plans and sections of new drive and forecourt | Date: from 1928 to

Contents:

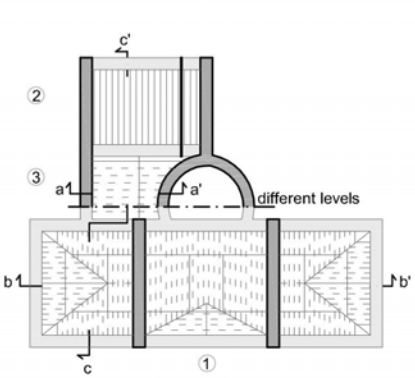
Summary and comments: Drawing by Lorimer showing replacement of the NorthEast roof of the North range in 1928



Legend (plans):

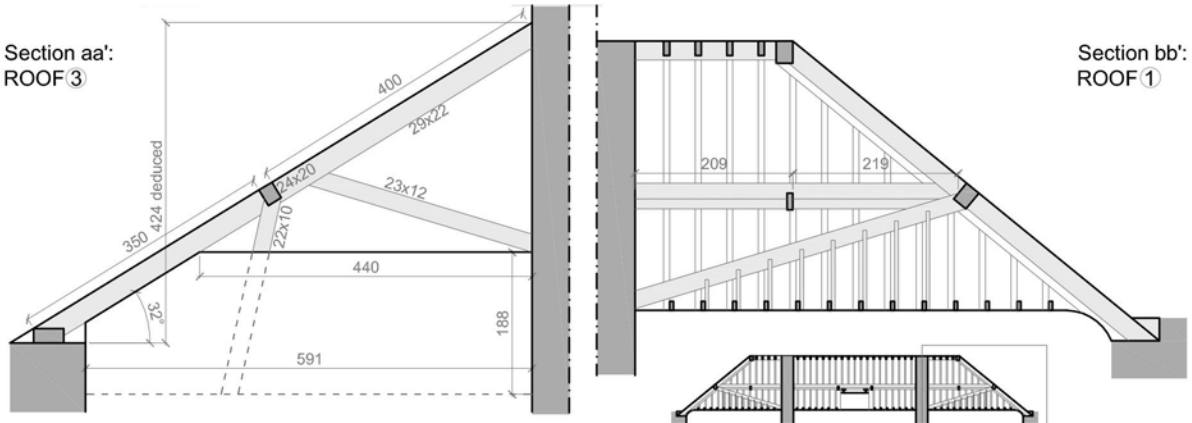
Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



Plan 1:1000 I:\Arch\ADCRU\1718cent scott

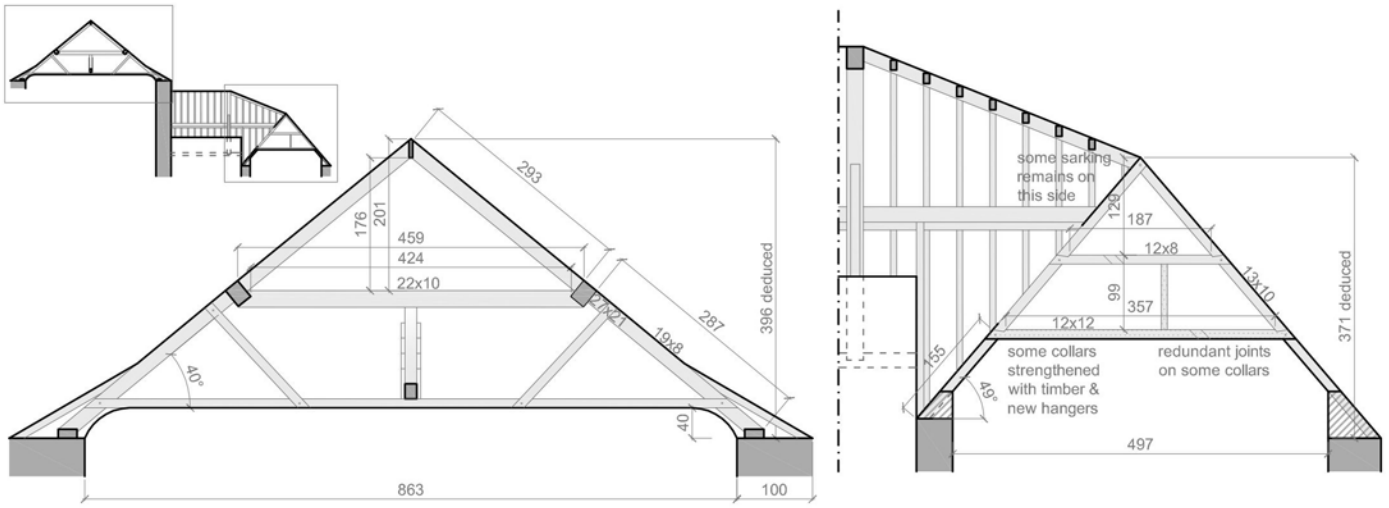
Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas



Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section cc': ROOF 1-3-2



Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** TOUCH HOUSE | **Roof location** 1: 18C block

Survey date(s) 12/08/2015 | See drawing: THH-MB-1

Roof Geometry: Hipped

Roof Max Span [m]: 8.6 | Roof Height [m]: 4

Roof Pitch/es [°]: 40 | Roof Length [m]: 23.4

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, sarking

Sarking boards: width [cm]: | thickness [cm]: 3

Connection with lateral walls: Wall-plate

Connection with gables: purlins

Roof Construction Period: From 1745 To 1755 | Identified by: Estimated

Roof General Description:

Hipped roof supported by two transversal walls and two longitudinal purlins, one on each side, and a slender ridge purlin. Horizontal struts, one on the sides and two at the centre, keep the purlins apart. The purlins support common rafters which in turn support the sarking. The ceiling is supported by collars that connect the common rafters. The pediment might be of later date, because there is sarking inside and the purlins have metal nails rather than timber pegs like the others.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: 27 | B 21

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description:

Between purlins and common rafters: double mortice and tenon with timber pegs not flush

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: strange marks (from scandinavia?)

Carpentry Marks Description:

only a few visible strange marks, not in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: purlin and common rafter | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

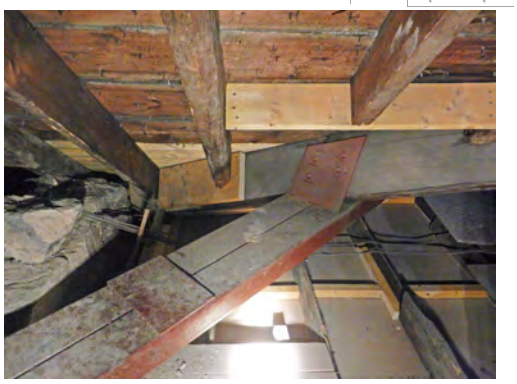
Unfavourable conditions: presence of pigeons/wasps/bats

Accessibility limitations: The west side of the roof is not accessible. There are bats everywhere.

Past interventions: The roof was strengthened in 1930s by Lorimer: he added two steel beams supporting the purlins in their central section. The steel beams sit on the external pediment and a wall extending from the rear wall. Dry rot was found in 2003 in the South East corner of the central part of the roof: a steel beam and new timber were added here to replace the rafter end.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains on purlins, sarking and common rafters. Possible fungi attack on South purlins near the gables.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks	Active	Primary
Connection Damage			



Humidity stains on purlin | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Possible fungi attack on purlin | link | I:\Arch\A

Description of visible damage: Cracks in horizontal struts due to purlins' deflection.

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** TOUCH HOUSE | **Roof location** 2: 17C block

Survey date(s) 12/08/2015 | See drawing: THH-MB-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 4.7 | Roof Height [m]: 3.46

Roof Pitch/es [°]: 49 | Roof Length [m]: 8.96

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: purlins, sarking

Sarking boards: width [cm] | thickness [cm]: 3

Connection with lateral walls: Unknown

Connection with gables: unknown

Roof Construction Period: From 1670 To 1700 | Identified by: Estimated

Roof General Description:

Gabled roof composed of 15 frames with two collars each. Ceiling is supported by lower collar. Connection with lateral walls not visible. Still reatains some of the original sarking inside, on the South side. Some timbers have redundant lap joints, they might have been reused. Others are not full logs but half logs, sawn in two. These are probably replacements of the 18th century.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 13 | B: 10 | Or Purlin - H: | B

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: cleat, dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: mortice and tenon with timber pegs not flush. Between rafters and collars: dovetail lapped with metal nails. Ther is a short purlin wityh cleats connecting some rafters on the north side.

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals, strange marks (from scandinavia?)

Carpentry Marks Description:

Roman numerals not in sequence. Some strange marks.

Signs of reused timbers: Redundant lap joints on some collars

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Redundant joints in collar | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance, poor ventilation

Accessibility limitations: Connection with lateral walls not visible

Past interventions: Some lower collars reinforced in timber and hangers hadded, probably during repair works in 1930s. Sarking replaced on North side.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

East gable is visibly wet and the masonry is disintegrating to dust and falling on the timbers and ceiling underneath. There is probably a problem of water ingress. The sarking is broken in some areas. A few areas might be affected by biotic attack.



East gable wet and disintegrating | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage	Splitting	Unknown	Collateral



Sarking broken and biotic attack | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: splitting of connection | link | I:\Arch\A

Description of visible damage: Some collars seem to be splitting at the joint with the rafters. This doesn't seem to be affecting the overall performance of the roof.

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** TOUCH HOUSE | **Roof location** 3: between 17C & 18C blocks

Survey date(s) 12/08/2015 | See drawing: THH-MB-1

Roof Geometry: Mono-pitch

Roof Max Span [m]: 3.7 | Roof Height [m]: 4.24

Roof Pitch/es [°]: 32 | Roof Length [m]: 5.5

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: purlins

Roof Construction Period: From 1745 To 1755 | Identified by: Estimated

Roof General Description:

A mono-pitch roof linking the 17C roof with the 18C one. Composed of one purlin running between the wall which separates the main block and the North range and a hip rafter ending on the cupola wall. The purlin supports a principal rafter in the centre of its length and common rafters all along. One strut goes from the wall to the principal rafter to hang the ceiling underneath. Another strut, almost vertical, supports the purlin and sits on a wall running East-West on which the 17th roof sits as well.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: 24 | B 20

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: Between purlisn and common rafters: double mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: strange marks (from scandinavia?)

Carpentry Marks Description:

Signs of reused timbers: Redundant joints in purlin: probably a principal rafter was removed?

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Redundant joints in purlin | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall only partly visible

Past interventions



Humidity stains | link | I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains in sarking and common rafters



Damage: purlin deflection | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks, Permanent Deformation	Active	Primary
Connection Damage			



Damage: strut cracking | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient overall arrangement, insufficient dimensions
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: Purlin is deflected and strut that supports it is cracked. Intervention needed urgently.

link | I:\Arch\A

Other Notes: Owner very helpful and eager to look into the building's history and problems

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link | I:\Arch\A

DETAILED SURVEY **Building name** TOUCH HOUSE **Roof location** 1: 18C block

Survey date(s) 17/02/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings THH-118C-1, THH-118C-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
hip rafter	685	rectangular	bending, compression		hand axed and hand sawn
principal rafter	625	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
upper collar	460	rectangular with wanes	bending, compression		hand axed and hand sawn
side purlin	405	rectangular	bending, compression		hand axed and hand sawn
end purlin	225	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
central purlin	810	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
common rafter	600	rectangular with wanes	bending, compression	pinus sylvestris	hand axed and hand sawn
sarking		sheet	bending, tension	pinus sylvestris	hand sawn
strut	460	rectangular	bending, compression		hand axed and hand sawn
lower collar	865		bending, tension		not visible
small strut	190	rectangular	tension		hand sawn

* estimated based on drawings because not fully accessible

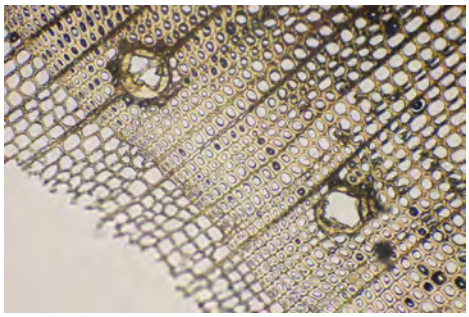
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings THH-118C-1, THH-118C-2

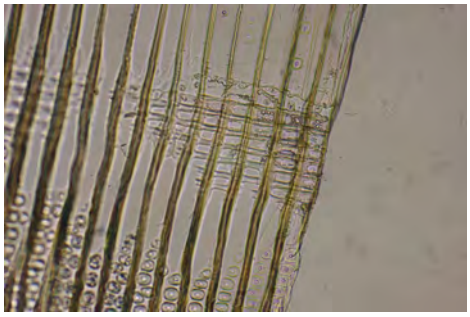
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
purlin & principal/hip rafter	Encounter mortice & tenon	compression	none	
common rafter & purlin	Encounter mortice & tenon	compression	wooden pegs	
rafter & lower collar	Encounter halved	tension	nails	
strut & rafter/collar	Encounter halved	tension	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

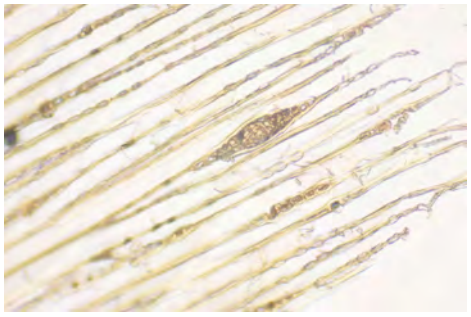
Microscopic identification of the timber species See drawing THH-118C-2



Principal rafter: transv. section x100 I:\Arc



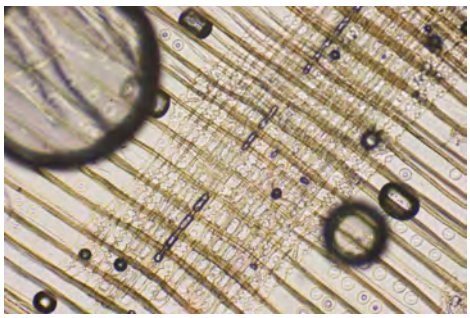
Principal rafter: radial section x100 I:\Arc



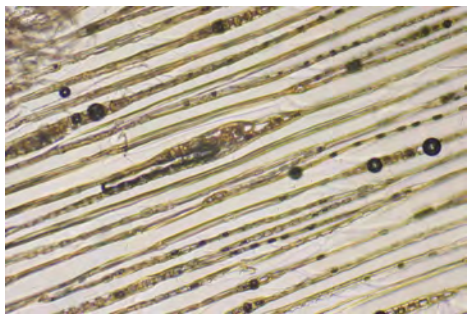
Principal rafter: tang. section x100 I:\Arc



Purlin: transv. section x100 I:\Arc



Purlin: radial section x100 I:\Arc



Purlin: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing THH-118C-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
attic space	centre	17/02/2016	10:20 am	13.6	55.8
attic space	E side	17/02/2016	10 am	14	54.7

roof space	centre	17/02/2016	11 am	10.1	72
roof space	E side	17/02/2016	10:40 am	10.8	66.1

Frame/Truss name all roof — See drawings THH-118C-2, THH-118C-

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack: E collar

Failed joints | Fungi attack: centre S purlin

Other: some wet areas in N purlins and side S purlin, shakes all along SE purlin, crack in E collar

Element name A east collar

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 22.5x9.2 | min. size (hxb) [cm]: 21x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 17 | tangential

Knots [min d/section h]: 4/21 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II



insect attack | I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: active | Way of identification: Estimated

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑ compression	unknown	
Crushing ☐		
Other ☐		

Estimated level of damage: medium | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☑ insufficient dimensions

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%]: 16.6 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 16.4 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%]: 17.8 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%]: 16.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B north east purlin

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 21x27.5 | min. size (hxb) [cm]: 21x27 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 2 | tangential

Knots [min d/section h] 3/28 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☑ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a			
Moisture Content [%] 15.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point b			
Moisture Content [%] 17.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point c			
Moisture Content [%] 18.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point d			
Moisture Content [%] 14.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	

Element name C south east purlin

Dating original construction | Signs of reuse

Timber treated ☐

Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 21.7x28 | min. size (hxb) [cm] 21.5x28 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 1 | tangential

Knots [min d/section h] 1/27.5 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☑ | Other

Mechanical Damage

Type | Status | Role



wet close to wall & fungi on rafter | I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 16 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 15.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d
Moisture Content [%] 16.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D big east strut

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 23.2x8.7 min. size (hxb) [cm] 22x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential
Knots [min d/section h] 5.5/22 group Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 21.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 20.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 22 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name E north east hip rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 26x12.7 min. size (hxb) [cm] 26x12.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 1 tangential

Knots [min d/section h] 6/26 group Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Measurement Point a

Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 15.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name F east principal rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 25.7x21.7 min. size (hxb) [cm] 25x21.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 2/22 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 18.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 15	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c		
Moisture Content [%] 15.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name G south east hip rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 27.5x14 min. size (hxb) [cm] 27.5x14 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Element name H east purlin

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19x23.7 min. size (hxb) [cm] 19x23 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 4/19 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects shakes all along south section

Estimated Strength Class according to UNI 11119 lower than III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 16.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name H' east purlin

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19.2x23 min. size (hxb) [cm] 19x23 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 5/19 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	25.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	14.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	16.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name I centre north purlin

Dating original construction Signs of reuse

Timber treated ☐

Past interventions 2 steel beams supporting the central section of the purlin

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 24.8x29 min. size (hxb) [cm] 24x28.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 12 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification



wet surface in central area I:\Arc

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 18.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 24 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 17.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point e

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point f

Moisture Content [%] 26.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name L centre south purlin

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions 2 steel beams supporting the central section of the purlin

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 23.8x29.1 min. size (hxb) [cm] 23x28.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 3/29 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



possible fungi attack near E gable I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☑ Type Unknown Status unknown

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 18.3 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point e

Moisture Content [%] 18.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point f

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point g

Moisture Content [%] 24.5 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Element name M centre east collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 22.5x6.5 min. size (hxb) [cm] 22x6 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 2/7.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑ compression	unknown	
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☑ insufficient dimensions

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage medium Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 18.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name N centre west collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 23.2x7.5 min. size (hxb) [cm] 23x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 2/8 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type Status
Way of identification

Fungi attack ☐ Type Status
Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

	Type	Status	Role
Deformation ☐			
Cracks ☑	compression	unknown	
Crushing ☐			
Other ☐			

Estimated level of damage: medium

Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☑ insufficient dimensions

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

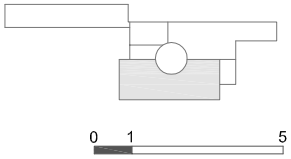
Measurement Point a			
Moisture Content [%]	16.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	17.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	14.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	18	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

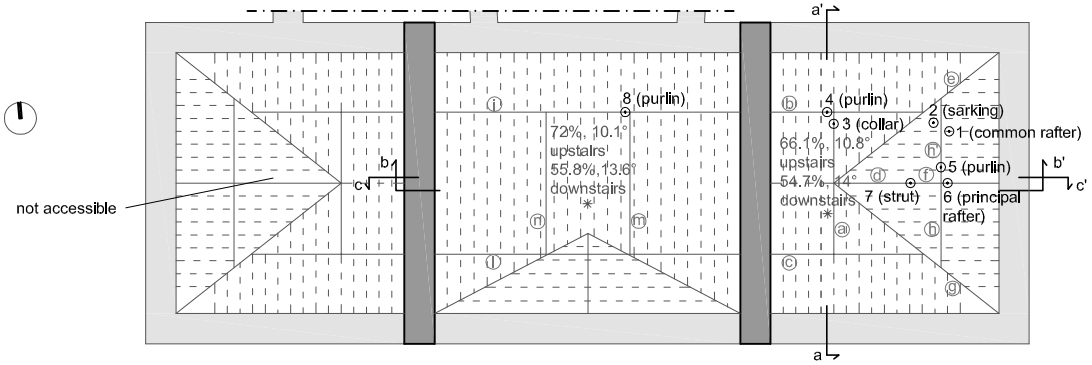
Building Name: Touch House | Roof Location: 18th century block | ANNA SERAFINI | Supervisors: Cristina Gonzalez Longo & Andrerw Agapiou
Drawing THH-118C-2 | PhD thesis | Architecture Department, University of Strathclyde

1061

Plan 1:200

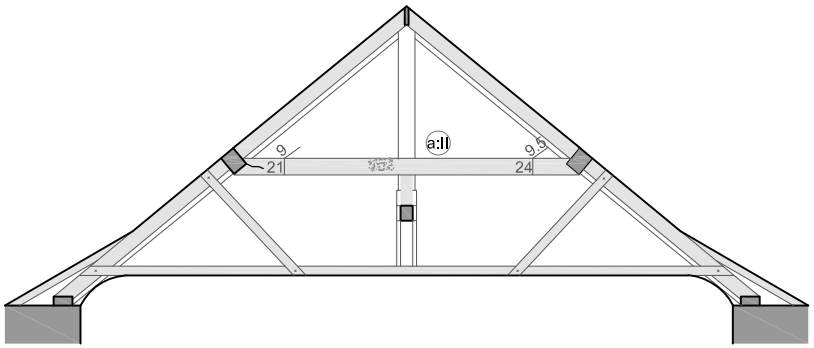
- ✳ air humidity and temperature
- ⊙ timber samples for species identification



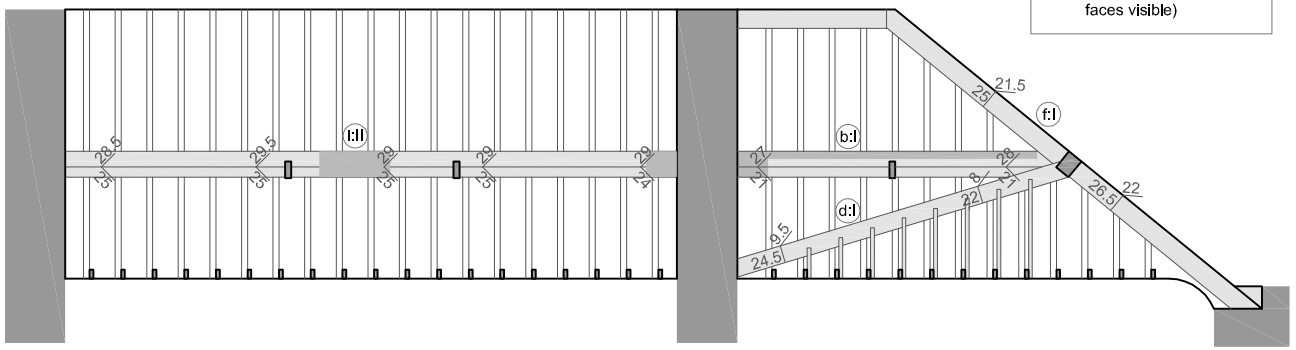


Visual inspection:
- shake
- crack
- wet surface
- fungi attack
- x:x element name : estimated strength class (na=less than 2 faces visible)

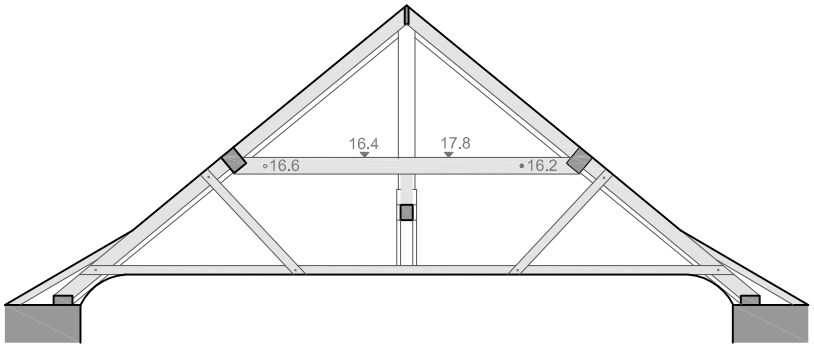
Section aa' 1:100

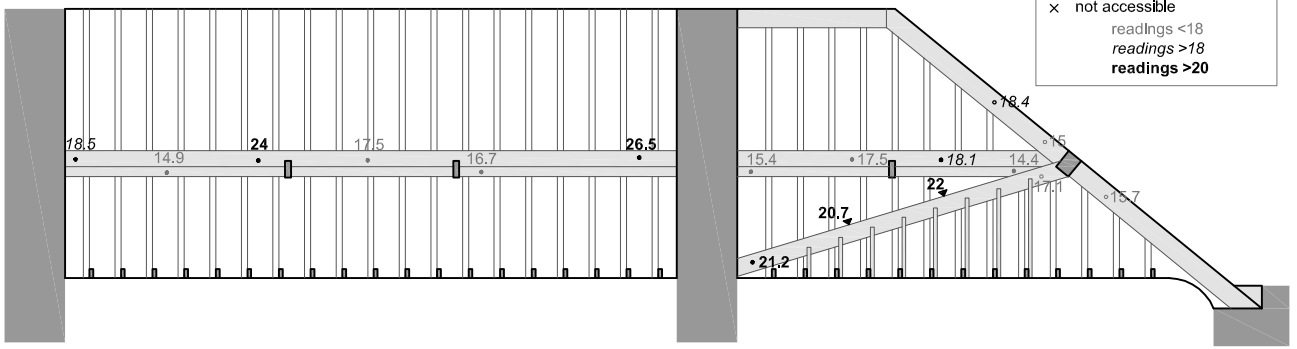


Section bb' 1:100



Moisture content readings:
- ▼ lower/upper/lateral face
- • visible face
- ◦ rear face
- × not accessible
- readings <18
- *readings >18*
- **readings >20**

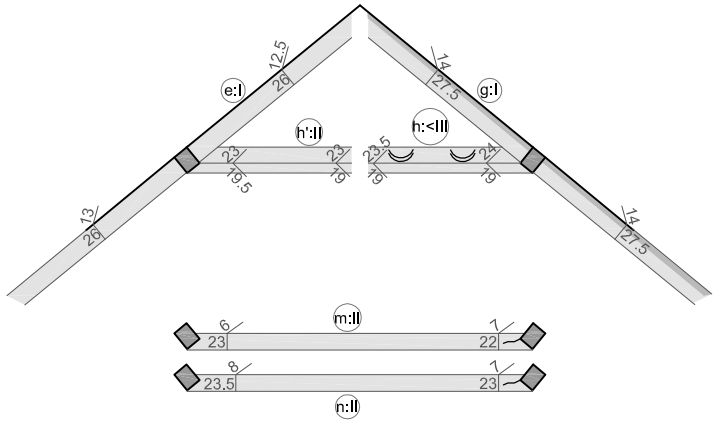




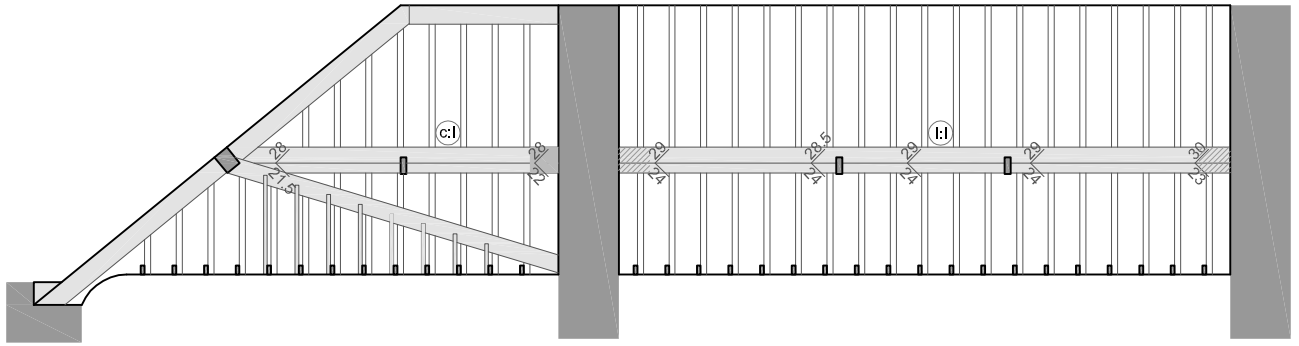
0 1 5

Visual inspection:
- shake
- crack
- wet surface
- fungi attack
- x:x element name : estimated strength class (na=less than 2 faces visible)

Section aa' 1:100

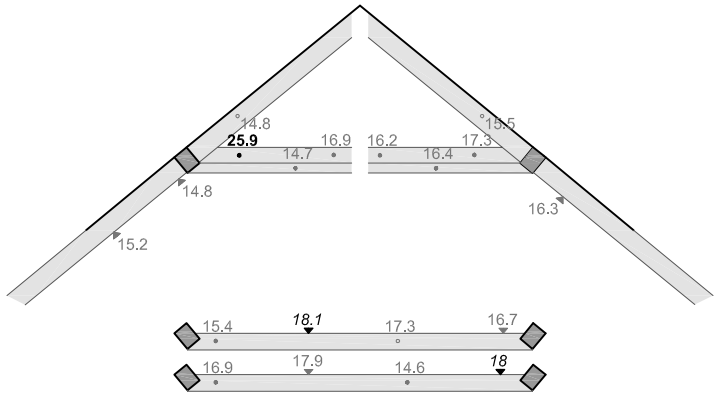


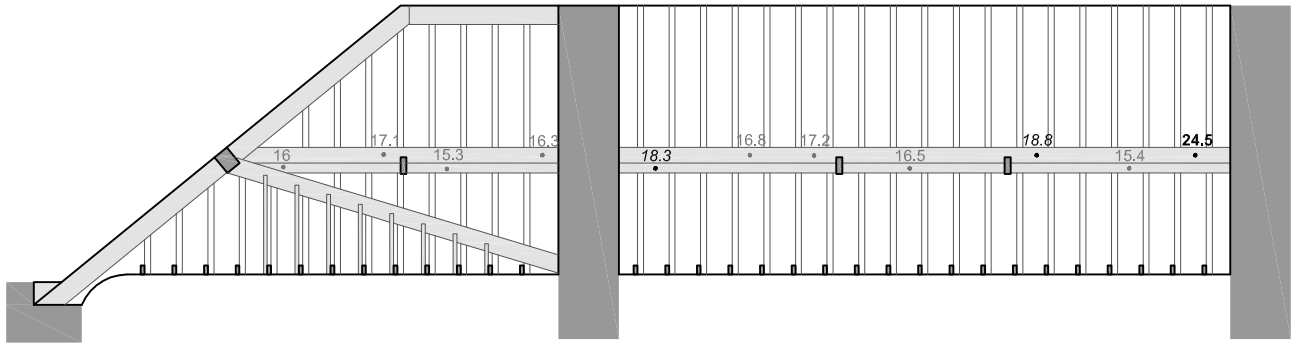
Section cc' 1:100



Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20





0 1 5

DETAILED SURVEY **Building name** TOUCH HOUSE **Roof location** 2: 17C block

Survey date(s) 17/02/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings THH-217C-1, THH-217C-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
rafter	455	rectangular with wanes	bending, compression	pinus sylvestris	hand axed and hand sawn
upper collar	240	rectangular with wanes	bending, compression	pinus sylvestris	hand axed and hand sawn
loer collar	410	rectangular with wanes	bending, tension	pinus sylvestris	hand axed and hand sawn
sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

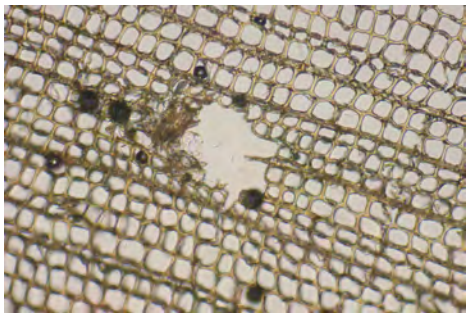
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings THH-217C-1, THH-217C-2

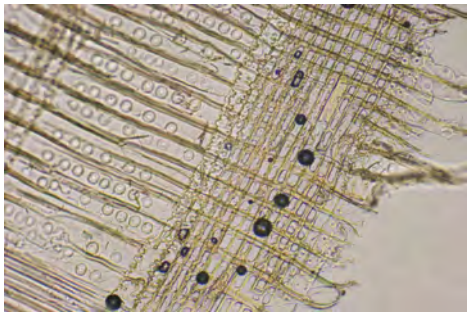
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter	Corner mortice & tenon	compression	wooden pegs	pinus sylvestris
rafter & collar	Encounter dovetail	compression, tension	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

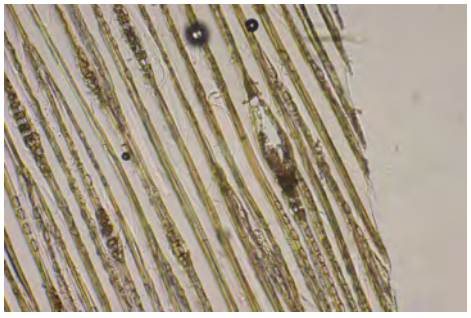
Microscopic identification of the timber species See drawing THH-217C-2



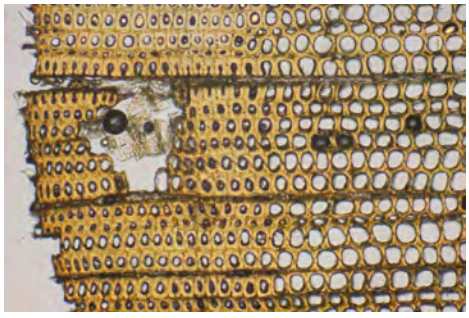
Rafter: transv. section x100 I:\Arc



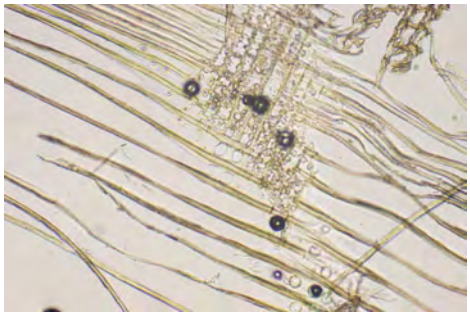
Rafter: radial section x100 I:\Arc



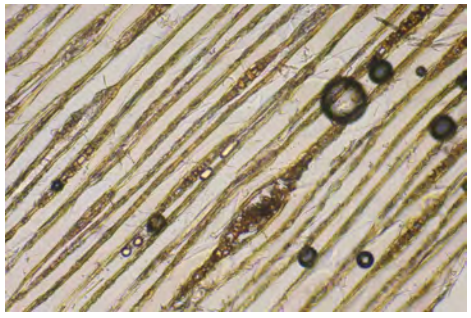
Rafter: tang. section x100 I:\Arc



Peg rafters' apex: transv. section x100 I:\Arc



Peg rafters' apex: radial section x100 I:\Arc



Peg rafters' apex: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing THH-217C-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	W side	17/02/2016	3:20 pm	10.4	67.3
roof space	E side	17/02/2016	3 pm	10.8	64
attic space	W side	17/02/2016	2:20 pm	10.5	60.7

attic space	E side	17/02/2016	2 pm	10.9	61.6	

Frame/Truss name non visible 13 | See drawing THH-217C-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints: between lower collar & N rafter | Fungi attack: S rafter

Other

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 12.5x9.5 | min. size (hxb) [cm]: 12.5x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 8 | tangential

Knots [min d/section h]: 1/13 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 16.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 17.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%]: 16.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B north rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 12.2x12 | min. size (hxb) [cm]: 11.5x12 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 9 | tangential

Knots [min d/section h]: 1/11 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 17.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 17.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c		
Moisture Content [%] 17.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C upper collar

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13.2x9.2 min. size (hxb) [cm] 12.5x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 3/9 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 18 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 21.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 19.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.2x10 min. size (hxb) [cm] 11x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 1.5/11 Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name non visible 9 See drawing THH-217C-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 10.5x8.2 min. size (hxb) [cm]: 10x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 10 tangential

Knots [min d/section h]: 3/8 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a			
Moisture Content [%]	16.2	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	17.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	16.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name B north rafter

Dating: original construction Signs of reuse

Timber treated ☐ Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 10.7x7.7 min. size (hxb) [cm]: 10.5x7.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 13 tangential

Knots [min d/section h]: 2.5/7.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other: sarking broken at rafters' apex



sarking broken at rafters' apex I:\Arc

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 19.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 19.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 18.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C upper collar

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 11.7x7.2 min. size (hxb) [cm] 11.5x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 5 tangential
Knots [min d/section h] 3/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 18.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 19.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 18.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.7x11.5 min. size (hxb) [cm] 11x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 8 tangential

Knots [min d/section h] 3/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a			
Moisture Content [%]	19.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	18.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	19.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	20.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name non visible 5 See drawing THH-217C-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other S rafter & upper collar wet

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.2x13 min. size (hxb) [cm] 11.5x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 26 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 15.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 15.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c		
Moisture Content [%] 17.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.2x10 min. size (hxb) [cm] 11.5x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 4/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 19.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C upper collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.7x8 min. size (hxb) [cm] 11x7.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential

Knots [min d/section h] 2/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type	Status	Role	
Deformation ☐			
Cracks ☐			
Crushing ☐			
Other ☐			

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Measurement Point a

Moisture Content [%] 19.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 19.3 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 20.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues only two faces visible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11x8 min. size (hxb) [cm] 11x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 2/11.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	16.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	16	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	15.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	15.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name non visible 1 See drawing THH-217C-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x8.7 min. size (hxb) [cm] 12x8.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 7 tangential

Knots [min d/section h] 5/8.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	22.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	21.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	20.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C upper collar

Dating: original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues: partly buried under masonry dust

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 13.2x9.5 min. size (hxb) [cm]: 13x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 3 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification



masonry dust on collar I:\Arc

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%]	23.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	b		
Moisture Content [%]	34.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	c		
Moisture Content [%]	29.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name D lower collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues: buried under masonry dust, very little visible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 10.7x12 | min. size (hxb) [cm]: 9.5x12 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 7 | tangential

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I



masonry dust on collar | I:\Arc

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☑ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

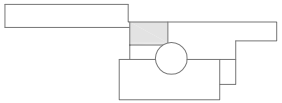
Estimated causes of primary damage

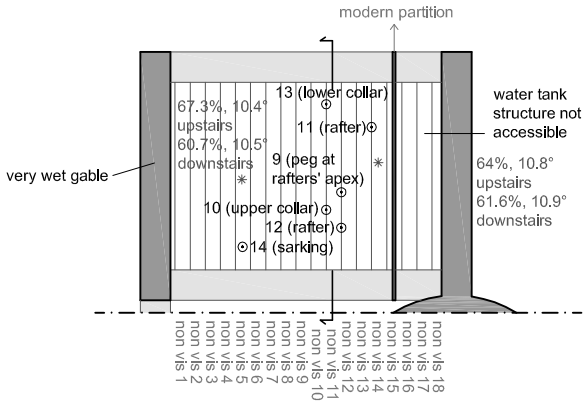
Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point	a		
Moisture Content [%]	33.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	b		
Moisture Content [%]	26	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	c		
Moisture Content [%]	24.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	d		
Moisture Content [%]	28.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Plan 1:200

- ✳ **air humidity and temperature**
- ⊙ timber samples for species identification





0 1 5

Sections looking West 1:100

Visual inspection:
many small knots & diffuse insect exit holes on most timbers

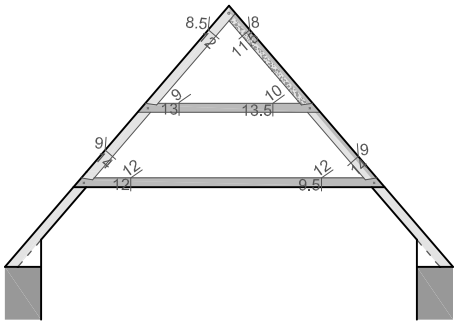
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- fungi attack
- Insect attack

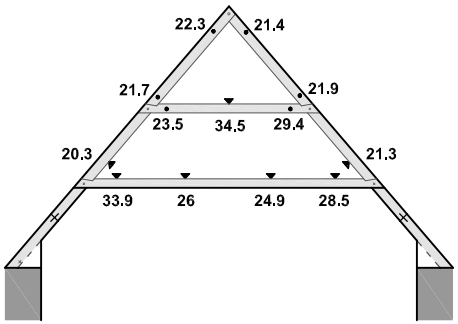
Moisture content readings:

- ▼ lower/upper/lateral face
- • visible face
- ◦ rear face
- × not accessible

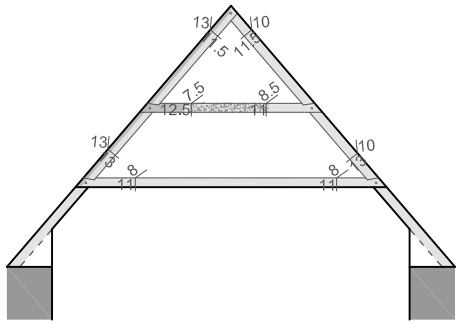
readings <18
readings >18
readings >20

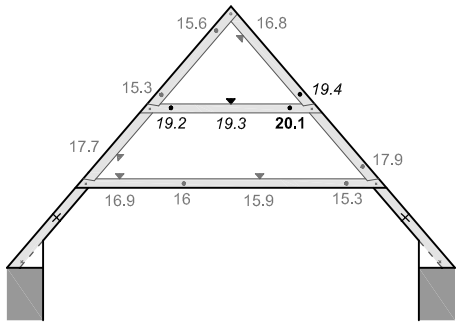
Frame non vis 1



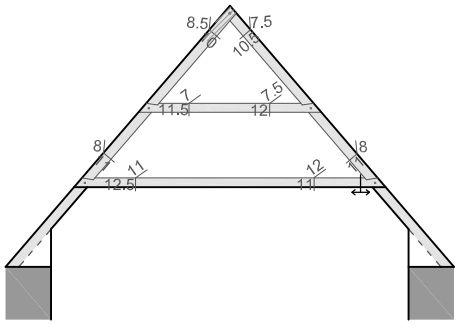


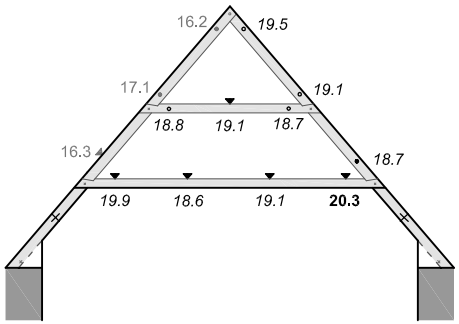
Frame non visible 5



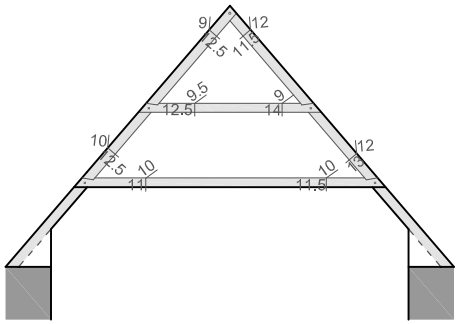


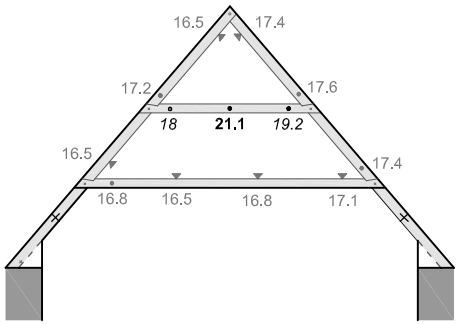
Frame non visible 9





Frame non visible 13





0 1 5

TOUCH HOUSE

Location: STIRLING | ST NINIANS
X coordinate: 275328 Y coordinate: 692755
Geogr. Referencing System: BRITISH NATIONAL GRID





Property status: PRIVATE
Rcahms ID: 46238
HS Listing: A

Original Use: Residential
Current Use: Residential

Freestanding: ☑ N. of floors above ground level: 3 Location link: I:\Arch\AD Building picture link: I:\Arch\ADCRU\1718cent s

INTERVENTIONS

Intervention type:	From:	To:	Description:	Reference:
CONSTRUCTION	1500	1599	Z PLAN TOWER HOUSE - TODAY ONLY SE TOWER AND LOWER PORTION OF NW TOWER REMAIN	HS

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1600	1699	NW TOWER REBUILT AND EXTENDED EAST (TODAY NORTH RANGE)	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ADDITION, ALTERATION	1757	1762	MAIN BLOCK OF THE ORIGINAL BUILDING REPLACED	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
ADAM	WILLIAM	ARCHITECT	☑
STEINSON	JAMES	ARCHITECT	☑
GRAY	GIDEON	CONTRACTOR, MASON	☐
CLAYTON	THOMAS	PLASTERER	☐
PATERSON	GEORGE	WRIGHT	☐
GIBSON	HENRY	WRIGHT	☐
SETON	HUGH (SMITH)	COMMISSIONERPATRON	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1800	1899	RANGE OF OFFICES AT THE NE ANGLE	CANMORE

People involved:

Intervention type:	From:	To:	Description:	Reference:
ALTERATION	1810		ELLIPTICAL STAIRS	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
GILLESPIE GRAHAM	JAMES	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
ADDITION	1927	1930	RENOVATION OF INTERIORS, STRENGTHENING OF MAIN BLOCK ROOF AND REPLACEMENT OF NORTHEAST ROOF OF NORTH RANGE - POSSIBLY REPAIRS IN NORTHWEST ROOF OF NORTH RANGE AS WELL	BUILDINGS OF SCOTLAND COLLECTION

People involved:

Last Name	First Name	Role	Attributed
LORIMER	SIR ROBERT	ARCHITECT	☐

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR, DAMAGE	1968		CUPOLA FELL OFF DURING STORM - IT WAS REPLACED AND ROOF STRENGTHENED	OWNER

People involved:

Intervention type:	From:	To:	Description:	Reference:
CONSERVRESTOR	2013		FOUND DRY ROT IN A CORNER OF THE ROOF - IT WAS REPAIRED WITH TIMBER AND STEEL	OWNER

People involved:

LITERATURE REFERENCES

Author	Year	Unpubl.	Title	Pages
DAVID MACGIBBON & THOMAS ROSS	1971	☐	VOLUME IV. CASTELLATED AND DOMESTIC ARCHITECTURE OF SCOTL THE TWELFTH TO THE EIGHTEENTH CENTURY	405
GIFFORD J.	2002	☐	THE BUILDINGS OF SCOTLAND COLLECTION: STIRLING AND CENTRAL	

ARCHIVAL REFERENCES

Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	Account of materials				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	Letter from timber merchant to Mr Seton				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	transcription of account of timber				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	account of timber				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	Account for haulage from Stirling dock to Touch by James Danskin				
Archive	Private: Touch House	Doc.Num.	uncatalogued	Folios	
Title	account				
Archive	RCAHMS	Doc.Num.	LOR/T/1/5	Folios	
Title	Plans, sections and elevations of verandah, repairs to North wing roof and coal cellar. Plans and sections of new drive and forecourt				

Suggestions for further research

Consulted archive documents

LEGEND
normal text = summarized parts
italic = direct transcription
? = not sure of one or more letters in the word preceding the question mark
??? = one word not possible to read

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: Account of materials | Date: from | to

Contents:
[…]
13 roods of scleatting @ 4£ 10sh per rood £58 – 10 – 0
468 yards of roofing and sarking @ 5sh a yard £117 – 0 – 0
592 feet of sheet lead for flanks & etc @ 18d £44 – 8 – 0
[…]

Summary and comments: Not dated but according to A. Mackechnie it could be late 17C. Not sure what 'roofing' implies, but this is not enough to be the construction of the roof on the old range. It's probably repairs and resarking only.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: Letter from timber merchant to Mr Seton | Date: from 1751 | to

Contents:
Dundee 27 September 1751
Mr. Setton,
Sir
I send you inclosed an Account of Wood bought from me by Mr. Geo. Paterson, Wright in Edinburgh, for your use and to your account which receive from the Bearer. I delivered the Wood here to Henry Gibson, one of Mr. Geo. Patersons foreman who ordered the logs to be cut out for your use as ordered by the by said Mr. Geo. Paterson his Master.
Please write me on Receipt of this, if it be convenient to pay the within account in Edinburgh, and where I shall call for it, or if it be more convenient for you, to pay the same at Alloa to James Kirk, Merchant thee, whose Receipt for the same shall be sufficiently good as my own, either of which is agreeable to,
Sir,
Your most obedient servant,
Ja. Key
[…]

Summary and comments: Letter from timber merchant to Mr Seton with account of timber bought by George Paterson, who must be the wright in charge of the timber works, and maybe more. The logs are brought on the construction site and cut there.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: account | Date: from 1757 | to

Contents:
Mr Robert Leckie for Hugh Seaton of Touch Esqr. To William Brown
1757
[…]
October 3 To livering 4 hundred 10 single sardish? Deals 110 ballons? and 30 sawn logs 3sh
To shoardues? As for 6 hundred deals @ 10p hund. 5sh
To waiting on timber altnight? one man 6d
[…]
To freight and port charges of timber ??? 2£ 11sh 4d
To man for waiting on timber all night 8d

Summary and comments:

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: account of timber | Date: from 1757 | to

Contents:
Hugh Seton Esqr. Of Touch
Bo't of Haig Deas & Co.
1757
Nov. 9 2 Copenhagen Logs measr. 59 ½ foot [18.7m] *@ 14d 3 – 9 – 5*
Cutting 6 Draught @ 8d 4
1758
April 4 26 Copenhagen Logs measr. 700 foot [219.8m] *@ 14d 40 – 16 – 8*
3 clean d.o for plank measr. 87 foot [27.3m] *@ d.o 5 – 1 – 6*
Cutting 96 draught @ 4 d 1 – 12 – 0
One barrel Stockholm Tar 1 – 5 – 0
April 18 11 Copenhagen Logs measr. 72 foot [22.6m] *@ 14 4 – 4 – 0*
Cutting 20 draught @ 4d 6 – 8
June 16 11 Copenhagen Logs measr. 362 ?? foot [113.6m] *@ 14 21 – 3 – 1*
One plank 3 inch thick [7.8cm] *12 foot* [3.8m] *long 2 – 6*

Cutting 24 Draught about 20 foot [6.28m] *long each @ 5d* *10 – 0*
Cutting 30 d.o @ 4d *10 – 0*
August 5 18 Riga Logs measr. 492 ?? foot [154.5m] *@ 14* *28 – 14 – 4*
August 19 Cutting 24 Draught each 23 foot [7.2m] *long @ 6d* *12 – 0*
Sept. 2 36 Riga Logs measured 1036 foot [325.3m] *@ 11* *60 – 8 – 8*
10 Norway 10&12 foot [3.2/3.8m] *Deals @ 11d and one hundred double flooring nails @ 12d for making affloat* *10 – 2*

£ 169 – 10 – 0
August 8 By your Draught on Charles Smith Esqr. *100 – 0 – 0*
Balance *69 – 10 – 0*

Alloa 21st November 1758 Received by the hands of Mr. Robert Leckie Payment of the above sum of Sixty nine Pounds Ten Shillings Sterling which is in full of all accounts. Haig Deas & Co.

Summary and comments: Account of wood bought for Mr Seton: Copenhagen (Norway) logs, Riga (Russia) logs, Norway deals and other small cuts. The Riga logs, being of higher quality, have probably been used for the purlins, whilst the Copenhagen logs have probably been used for the common rafters.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: transcription of account of timber | Date: from 1757 to

Contents:
Mr Setton of Touch by Mr Geo. Paterson
Bought off Jas Key, Dundee
1757
September 10th
To 30 Redwood scots pine Logs 9,209 Solid feet @ 9d. *10 – 2 - 4*
To 410 Best Superfine picked Gotenburg 1 ¼ Inch Deals @ 8£ p *32 – 13 – 4*
To Carriage paid to the Ship *5 – 0*
To Cash paid to Customhouse for a permit *2 – 0*
---
48 – 12 – 8

Summary and comments: Account of wood bought by George Paterson for Mr Seton: 30 scots pine logs and 410 high quality deals from Gotenburg (Sweden). This timber is probably for the roofs of the new house - the deals are sufficient to make the sarking of the central block, the logs could be for the common rafters.

Archive: Private: Touch House | Doc. Num.: uncatalogued | Folios:

Title: Account for haulage from Stirling dock to Touch by James Danskin | Date: from 1758 to

Contents:
James Danskin, Account for Haulage from Stirling dock to Touch
An account of money paid for Livering free Stones and Wood and Lead and Sclates for the use of Mr Seaton of Touch at the Shor of Stirling
1758
[…]
August 23 For taking out the float of wood paid 6sh
[…]
For taking care of wood lying at the Shor 2sh
[…]

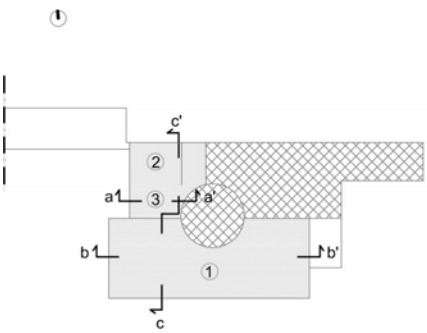
Summary and comments: Account of transport of materials to the house. No details on materials carried.

Archive: RCAHMS | Doc. Num.: LOR/T/1/5 | Folios:

Title: Plans, sections and elevations of verandah, repairs to North wing roof and coal cellar. Plans and sections of new drive and forecourt | Date: from 1928 to

Contents:

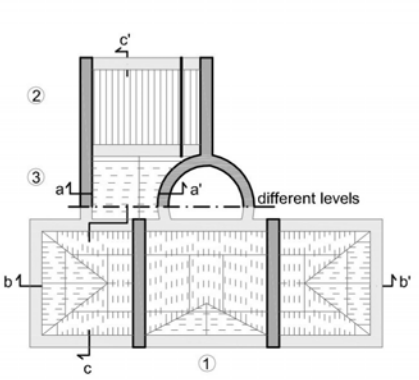
Summary and comments: Drawing by Lorimer showing replacement of the NorthEast roof of the North range in 1928



Legend (plans):

Plan 1:1000
- Surveyed roof
- Post-1800 roofs
- Not Accessible roofs

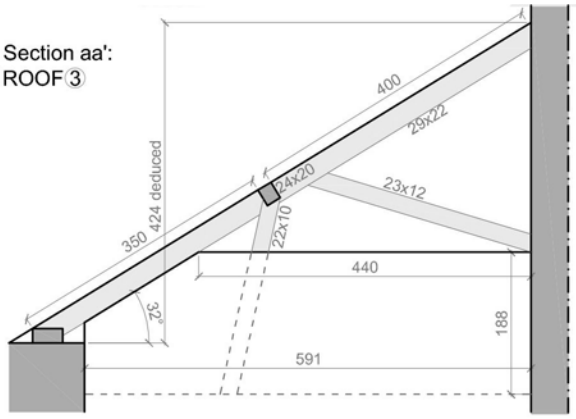
Plan 1:500
- Primary structure
- Secondary structure
- Past Interventions
- Carpentry marks



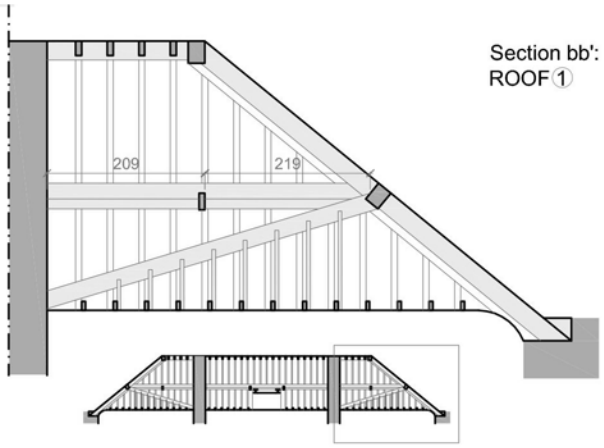
Plan 1:1000 I:\Arch\ADCRU\1718cent scott

Plan 1:500 I:\Arch\ADCRU\1718cent scottish buildings databas

Section aa': ROOF 3



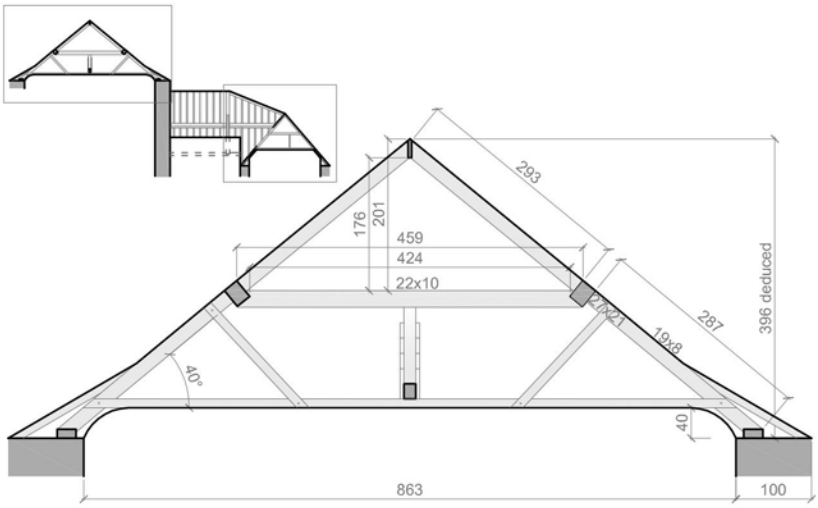
Section bb': ROOF 1

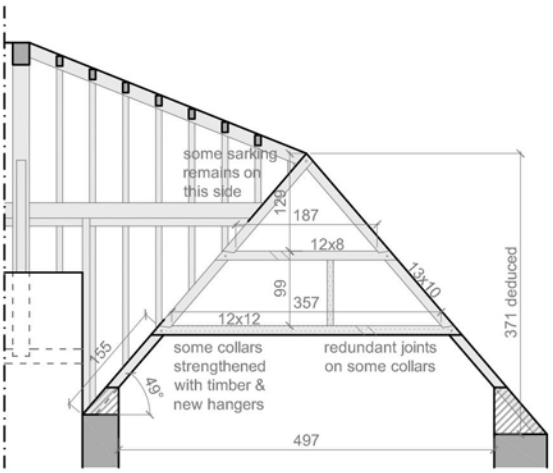


Legend (section):
- Past Interventions
- Assumptions (not visible)
- Timber pegs/dowels
- Metal nails/spikes

Dimensions in cm (where dimensions are not provided, it was not possible to take measurements)

Section cc': ROOF 1-3-2





Section 1: 100 I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber roofs key b

0 1 5

INITIAL SURVEY | **Building name** TOUCH HOUSE | **Roof location** 1: 18C block

Survey date(s) 12/08/2015 | See drawing: THH-MB-1

Roof Geometry: Hipped

Roof Max Span [m]: 8.6 | Roof Height [m]: 4

Roof Pitch/es [°]: 40 | Roof Length [m]: 23.4

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, sarking

Sarking boards: width [cm]: | thickness [cm]: 3

Connection with lateral walls: Wall-plate

Connection with gables: purlins

Roof Construction Period: From 1745 To 1755 | Identified by: Estimated

Roof General Description:

Hipped roof supported by two transversal walls and two longitudinal purlins, one on each side, and a slender ridge purlin. Horizontal struts, one on the sides and two at the centre, keep the purlins apart. The purlins support common rafters which in turn support the sarking. The ceiling is supported by collars that connect the common rafters. The pediment might be of later date, because there is sarking inside and the purlins have metal nails rather than timber pegs like the others.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: 27 | B 21

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description:

Between purlins and common rafters: double mortice and tenon with timber pegs not flush

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: strange marks (from scandinavia?)

Carpentry Marks Description:

only a few visible strange marks, not in sequence

Signs of reused timbers:

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Connection with wall | link I:\Arch\A



Timber dressing | link I:\Arch\A



Joints: purlin and common rafter | link I:\Arch\A



Carpentry marks | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☑ Insulation on sarking ☐

Decorative features

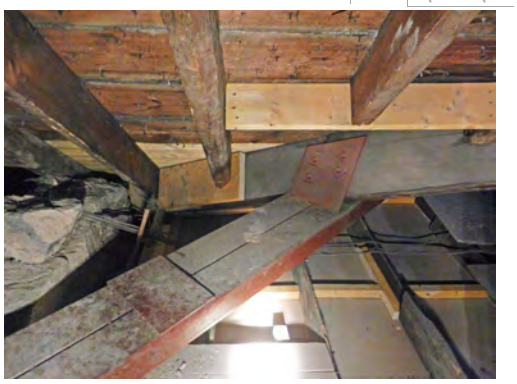
Unfavourable conditions: presence of pigeons/wasps/bats

Accessibility limitations: The west side of the roof is not accessible. There are bats everywhere.

Past interventions: The roof was strengthened in 1930s by Lorimer: he added two steel beams supporting the purlins in their central section. The steel beams sit on the external pediment and a wall extending from the rear wall. Dry rot was found in 2003 in the South East corner of the central part of the roof: a steel beam and new timber were added here to replace the rafter end.



Past interventions | link | I:\Arch\A



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains on purlins, sarking and common rafters. Possible fungi attack on South purlins near the gables.

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks	Active	Primary
Connection Damage			



Humidity stains on purlin | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Possible fungi attack on purlin | link | I:\Arch\A

Description of visible damage: Cracks in horizontal struts due to purlins' deflection.

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** TOUCH HOUSE | **Roof location** 2: 17C block

Survey date(s) 12/08/2015 | See drawing: THH-MB-1

Roof Geometry: Two-pitch gabled

Roof Max Span [m]: 4.7 | Roof Height [m]: 3.46

Roof Pitch/es [°]: 49 | Roof Length [m]: 8.96

Type of Primary Structure: 2D framing

Truss ☐

Frame ☑ Collar/s

Average Distance in between Primary Structure [m]: 0.45

Type of Secondary Structure: purlins, sarking

Sarking boards: width [cm] | thickness [cm]: 3

Connection with lateral walls: Unknown

Connection with gables: unknown

Roof Construction Period: From 1670 To 1700 | Identified by: Estimated

Roof General Description:

Gabled roof composed of 15 frames with two collars each. Ceiling is supported by lower collar. Connection with lateral walls not visible. Still reatains some of the original sarking inside, on the South side. Some timbers have redundant lap joints, they might have been reused. Others are not full logs but half logs, sawn in two. These are probably replacements of the 18th century.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular with wanes

Rafter Scantling [cm] H: 13 B: 10 | Or Purlin - H: B:

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: cleat, dovetail, lapped, mortice and tenon

Fasteners Types: Metal nail, Timber peg not flush

Joints description:

Rafters' apex: mortice and tenon with timber pegs not flush. Between rafters and collars: dovetail lapped with metal nails. Ther is a short purlin wityh cleats connecting some rafters on the north side.

Wood Species: all pinus sylvestris | Way of identification: direct micro

Carpentry Marks Types: big roughly cut roman numerals, strange marks (from scandinavia?)

Carpentry Marks Description:

Roman numerals not in sequence. Some strange marks.

Signs of reused timbers: Redundant lap joints on some collars

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Joints: rafter and collar | link I:\Arch\A



Joints: rafters' apex | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Redundant joints in collar | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions: poor maintenance, poor ventilation

Accessibility limitations: Connection with lateral walls not visible

Past interventions: Some lower collars reinforced in timber and hangers hadded, probably during repair works in 1930s. Sarking replaced on North side.



Past interventions | link | I:\Arch\A

Material Degradation: Fungi attack ☑ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

East gable is visibly wet and the masonry is disintegrating to dust and falling on the timbers and ceiling underneath. There is probably a problem of water ingress. The sarking is broken in some areas. A few areas might be affected by biotic attack.



East gable wet and disintegrating | link | I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage			
Connection Damage	Splitting	Unknown	Collateral



Sarking broken and biotic attack | link | I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☐
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐



Damage: splitting of connection | link | I:\Arch\A

Description of visible damage: Some collars seem to be splitting at the joint with the rafters. This doesn't seem to be affecting the overall performance of the roof.

Other Notes

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link

INITIAL SURVEY | **Building name** TOUCH HOUSE | **Roof location** 3: between 17C & 18C blocks

Survey date(s) 12/08/2015 | See drawing: THH-MB-1

Roof Geometry: Mono-pitch

Roof Max Span [m]: 3.7 | Roof Height [m]: 4.24

Roof Pitch/es [°]: 32 | Roof Length [m]: 5.5

Type of Primary Structure: Purlins

Truss ☐

Frame ☐

Average Distance in between Primary Structure [m]:

Type of Secondary Structure: common rafters, sarking

Sarking boards: width [cm] | thickness [cm]

Connection with lateral walls: Wall-plate

Connection with gables: purlins

Roof Construction Period: From 1745 To 1755 | Identified by: Estimated

Roof General Description:

A mono-pitch roof linking the 17C roof with the 18C one. Composed of one purlin running between the wall which separates the main block and the North range and a hip rafter ending on the cupola wall. The purlin supports a principal rafter in the centre of its length and common rafters all along. One strut goes from the wall to the principal rafter to hang the ceiling underneath. Another strut, almost vertical, supports the purlin and sits on a wall running East-West on which the 17th roof sits as well.

Roofing Material: slate

Roofing Material Fixing: Metal nails

Timber elements' Section Shape: Rectangular

Rafter Scantling [cm] H: | B: | Or Purlin - H: 24 | B 20

Timber elements' Dressing: rustic (hand-axed), rustic (hand-sawn) | Bark ☐

Joint Types: mortice and tenon

Fasteners Types: Timber peg not flush

Joints description: Between purlisn and common rafters: double mortice and tenon with timber pegs not flush

Wood Species: softwood, probably pine | Way of identification: estimated

Carpentry Marks Types: strange marks (from scandinavia?)

Carpentry Marks Description:

Signs of reused timbers: Redundant joints in purlin: probably a principal rafter was removed?

Timber Treated ☐

Other Materials:

Dendrochronology:



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Roof structure | link I:\Arch\A



Carpentry marks | link I:\Arch\A



Redundant joints in purlin | link I:\Arch\A

Roof space in use ☐ Insulation on ceiling ☐ Insulation on sarking ☐

Decorative features

Unfavourable conditions

Accessibility limitations: Connection with wall only partly visible

Past interventions



Humidity stains | link I:\Arch\A

Material Degradation: Fungi attack ☐ Insect attack ☐ Humidity stains ☑ Diffuse insect exit holes ☑

Humidity stains in sarking and common rafters



Damage: purlin deflection | link I:\Arch\A

	Damage Type:	Damage Status:	Damage Role:
Roof Damage			
Unit Damage			
Element Damage	Cracks, Permanent Deformation	Active	Primary
Connection Damage			



Damage: strut cracking | link I:\Arch\A

Estimated cause(s) of the primary damage:

- Poor Design ☑ inefficient overall arrangement, insufficient dimensions
- Poor Construction ☐
- Poor Maintenance ☐
- Material Degradation ☐
- Past interventions ☐
- Extreme actions ☐
- Other ☐

Description of visible damage: Purlin is deflected and strut that supports it is cracked. Intervention needed urgently.

link I:\Arch\A

Other Notes: Owner very helpful and eager to look into the building's history and problems

Attachments: I:\Arch\ADCRU\1718cent scottish buildings database\timber roofs\timber | link I:\Arch\A

DETAILED SURVEY **Building name** TOUCH HOUSE **Roof location** 1: 18C block

Survey date(s) 17/02/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings THH-118C-1, THH-118C-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
hip rafter	685	rectangular	bending, compression		hand axed and hand sawn
principal rafter	625	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
upper collar	460	rectangular with wanes	bending, compression		hand axed and hand sawn
side purlin	405	rectangular	bending, compression		hand axed and hand sawn
end purlin	225	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
central purlin	810	rectangular	bending, compression	pinus sylvestris	hand axed and hand sawn
common rafter	600	rectangular with wanes	bending, compression	pinus sylvestris	hand axed and hand sawn
sarking		sheet	bending, tension	pinus sylvestris	hand sawn
strut	460	rectangular	bending, compression		hand axed and hand sawn
lower collar	865		bending, tension		not visible
small strut	190	rectangular	tension		hand sawn

* estimated based on drawings because not fully accessible

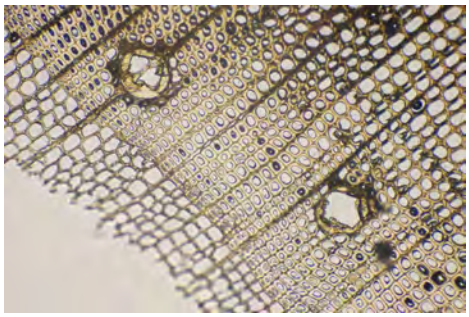
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings THH-118C-1, THH-118C-2

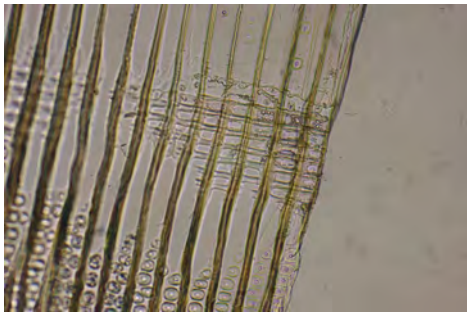
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
purlin & principal/hip rafter	Encounter mortice & tenon	compression	none	
common rafter & purlin	Encounter mortice & tenon	compression	wooden pegs	
rafter & lower collar	Encounter halved	tension	nails	
strut & rafter/collar	Encounter halved	tension	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

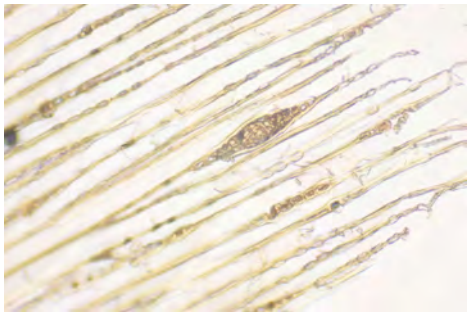
Microscopic identification of the timber species See drawing THH-118C-2



Principal rafter: transv. section x100 I:\Arc



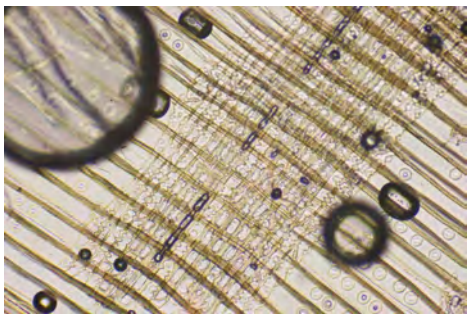
Principal rafter: radial section x100 I:\Arc



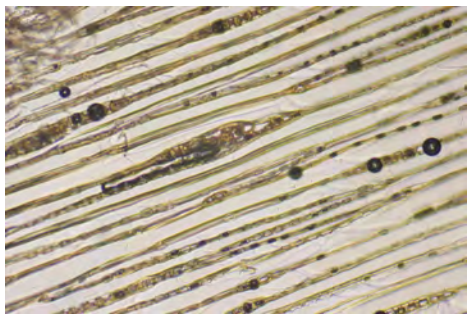
Principal rafter: tang. section x100 I:\Arc



Purlin: transv. section x100 I:\Arc



Purlin: radial section x100 I:\Arc



Purlin: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing THH-118C-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
attic space	centre	17/02/2016	10:20 am	13.6	55.8
attic space	E side	17/02/2016	10 am	14	54.7

roof space	centre	17/02/2016	11 am	10.1	72
roof space	E side	17/02/2016	10:40 am	10.8	66.1

Frame/Truss name all roof — See drawings THH-118C-2, THH-118C-

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack: E collar

Failed joints | Fungi attack: centre S purlin

Other: some wet areas in N purlins and side S purlin, shakes all along SE purlin, crack in E collar

Element name A east collar

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 22.5x9.2 | min. size (hxb) [cm]: 21x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 17 | tangential

Knots [min d/section h]: 4/21 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II



insect attack | I:\Arc

Material degradation

Insect attack ☑ | Type: Anobium Punctatum | Status: active

Way of identification: Estimated

Fungi attack ☐ | Type | Status

Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑ compression	unknown	
Crushing ☐		
Other ☐		

Estimated level of damage: medium | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☑ insufficient dimensions

Poor construct. ☐

Degradation ☐ | Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%]: 16.6 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 16.4 | Visible Material Degradation ☑ | Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%]: 17.8 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%]: 16.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B north east purlin

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 21x27.5 | min. size (hxb) [cm]: 21x27 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 2 | tangential

Knots [min d/section h] 3/28 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☑ | Other

Mechanical Damage

Type | Status | Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a			
Moisture Content [%] 15.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point b			
Moisture Content [%] 17.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point c			
Moisture Content [%] 18.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	
Measurement Point d			
Moisture Content [%] 14.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐	

Element name C south east purlin

Dating original construction | Signs of reuse

Timber treated ☐

Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 21.7x28 | min. size (hxb) [cm] 21.5x28 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location centre | Slope of grain [%] 1 | tangential

Knots [min d/section h] 1/27.5 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type | Status | Way of identification

Fungi attack ☐ Type | Status | Way of identification

Corrosion ☐ | Wet surface ☑ | Other

Mechanical Damage

Type | Status | Role



wet close to wall & fungi on rafter | I:\Arc

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a			
Moisture Content [%]	16	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	17.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	15.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	16.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name D big east strut

Dating original construction
Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 23.2x8.7 min. size (hxb) [cm] 22x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side
Slope of grain [%] 1 tangential
Knots [min d/section h] 5.5/22 group
Knotty element ☐
Defects in critical area ☐
Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a			
Moisture Content [%]	21.2	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	20.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	22	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name E north east hip rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 26x12.7 min. size (hxb) [cm] 26x12.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 1 tangential

Knots [min d/section h] 6/26 group Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Measurement Point a

Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 15.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name F east principal rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 25.7x21.7 min. size (hxb) [cm] 25x21.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 2/22 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 18.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 15	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c		
Moisture Content [%] 15.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name G south east hip rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 27.5x14 min. size (hxb) [cm] 27.5x14 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 2 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 15.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] Visible Material Degradation ☐ Not Accessible for: hygrometer ☑

Element name H east purlin

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19x23.7 min. size (hxb) [cm] 19x23 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 4/19 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects shakes all along south section

Estimated Strength Class according to UNI 11119 lower than III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 16.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name H' east purlin

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 19.2x23 min. size (hxb) [cm] 19x23 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 5 tangential

Knots [min d/section h] 5/19 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	25.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	14.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	16.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name I centre north purlin

Dating original construction Signs of reuse

Timber treated ☐

Past interventions 2 steel beams supporting the central section of the purlin

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 24.8x29 min. size (hxb) [cm] 24x28.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 12 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification



wet surface in central area I:\Arc

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 18.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 14.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 24 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 17.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point e

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point f

Moisture Content [%] 26.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name L centre south purlin

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions 2 steel beams supporting the central section of the purlin

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 23.8x29.1 min. size (hxb) [cm] 23x28.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location centre Slope of grain [%] 3 tangential

Knots [min d/section h] 3/29 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I



possible fungi attack near E gable I:\Arc

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☑ Type Unknown Status unknown

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage

Poor design ☐ Poor construct. ☐ Degradation ☐ Poor maintenance ☐ Past interv. ☐ External actions ☐ Other ☐

Measurement Point a

Moisture Content [%] 18.3 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point e

Moisture Content [%] 18.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point f

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point g

Moisture Content [%] 24.5 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Element name M centre east collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 22.5x6.5 min. size (hxb) [cm] 22x6 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 2/7.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑ compression	unknown	
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☑ insufficient dimensions

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage medium Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 15.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 18.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.3 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 16.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name N centre west collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 23.2x7.5 min. size (hxb) [cm] 23x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 1 tangential

Knots [min d/section h] 2/8 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type Status
Way of identification

Fungi attack ☐ Type Status
Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☑ compression	unknown	
Crushing ☐		
Other ☐		

Estimated level of damage: medium

Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☑ insufficient dimensions

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

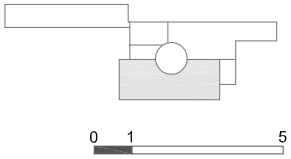
External actions ☐

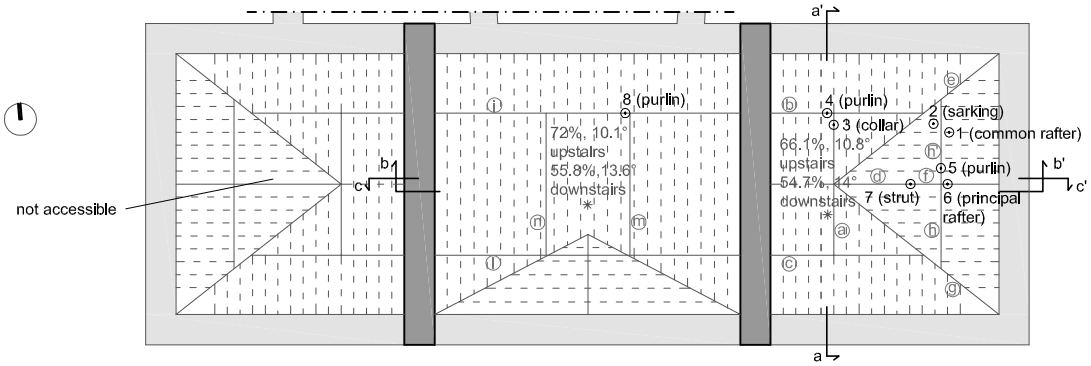
Other ☐

Measurement Point a			
Moisture Content [%]	16.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	17.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	14.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	18	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Plan 1:200

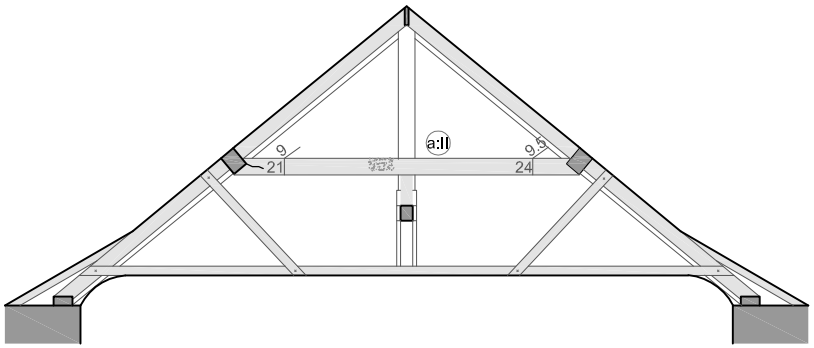
- air humidity and temperature
- timber samples for species identification



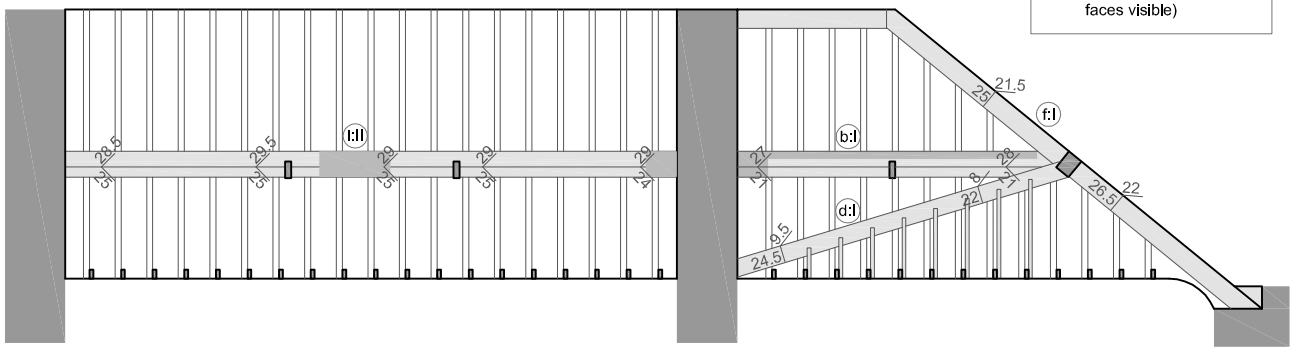


Visual inspection:
- shake
- crack
- wet surface
- fungi attack
- x:x element name : estimated strength class (na=less than 2 faces visible)

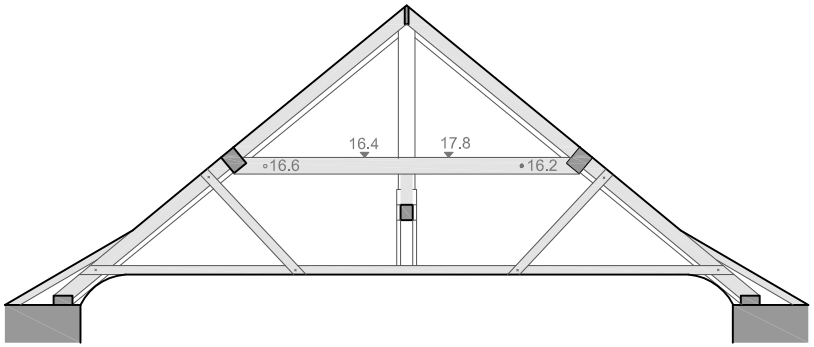
Section aa' 1:100

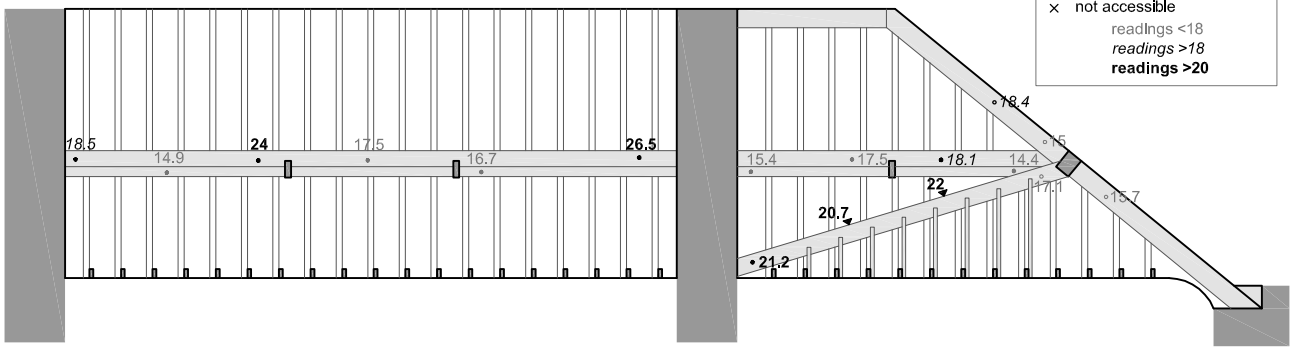


Section bb' 1:100



Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible
- readings <18
- *readings >18*
- **readings >20**

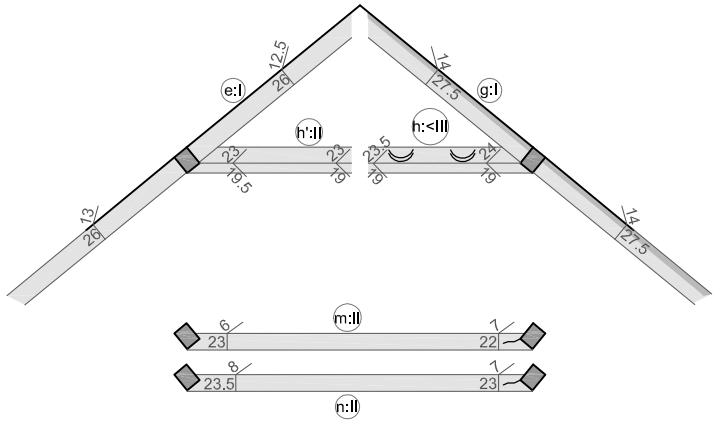




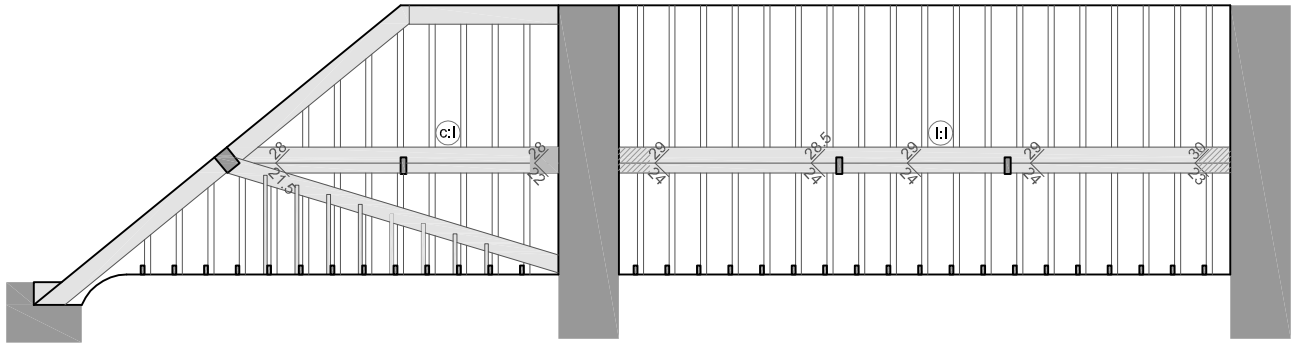
0 1 5

Visual inspection:
- shake
- crack
- wet surface
- fungi attack
- x:x element name : estimated strength class (na=less than 2 faces visible)

Section aa' 1:100

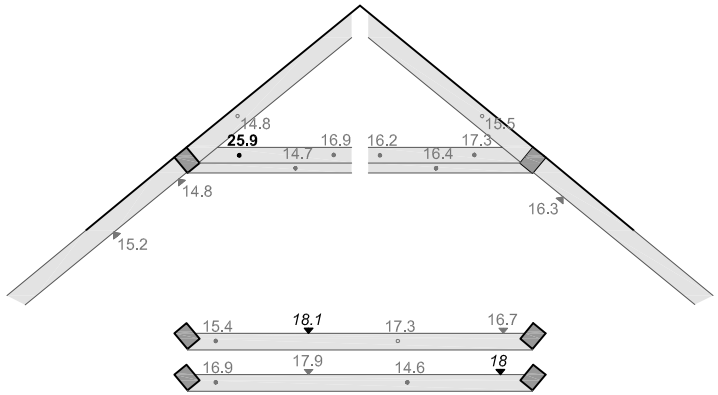


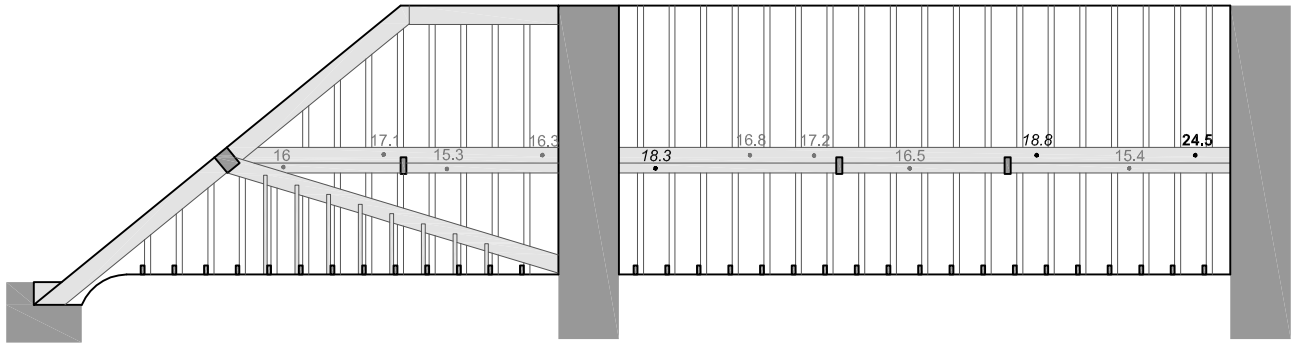
Section cc' 1:100



Moisture content readings:
- lower/upper/lateral face
- visible face
- rear face
- not accessible

readings <18
readings >18
readings >20





0 1 5

DETAILED SURVEY **Building name** TOUCH HOUSE **Roof location** 2: 17C block

Survey date(s) 17/02/2016

Elements: lengths, section shapes, stresses applied, timber species, timber dressing See drawings THH-217C-1, THH-217C-2

Element type:	Length [cm]	Section shape:	Working in (estimated):	Timber species # :	Timber dressing:
rafter	455	rectangular with wanes	bending, compression	pinus sylvestris	hand axed and hand sawn
upper collar	240	rectangular with wanes	bending, compression	pinus sylvestris	hand axed and hand sawn
loer collar	410	rectangular with wanes	bending, tension	pinus sylvestris	hand axed and hand sawn
sarking		sheet	bending, tension	pinus sylvestris	hand sawn

* estimated based on drawings because not fully accessible

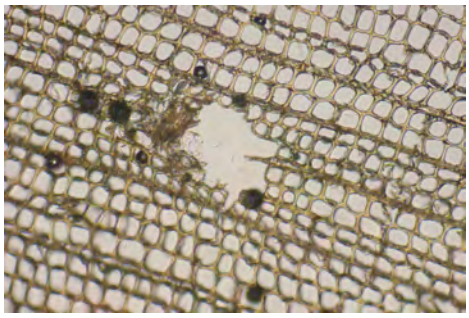
identified with a light transmission microscope analysing maximum 2 samples for each element type - based on visual inspection the other elements have been assumed to be of the same species

Joints: types, stresses applied and timber species See drawings THH-217C-1, THH-217C-2

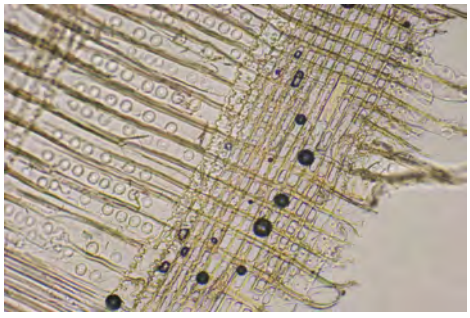
Joint position:	Joint type:	Working in (estimated):	Fastener type:	Timber species # :
rafter & rafter	Corner mortice & tenon	compression	wooden pegs	pinus sylvestris
rafter & collar	Encounter dovetail	compression, tension	nails	

identified with a light transmission microscope analysing maximum 2 samples for each fastener - based on visual inspection the other fasteners have been assumed to be of the same species

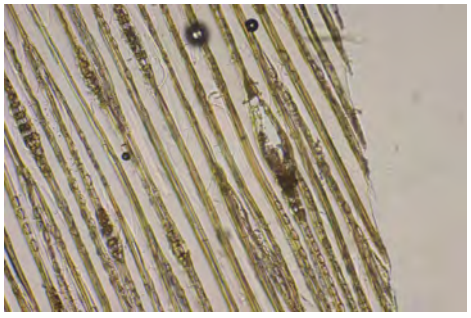
Microscopic identification of the timber species See drawing THH-217C-2



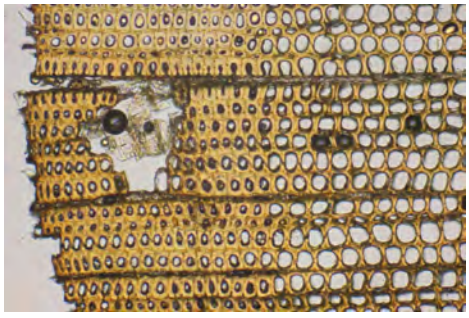
Rafter: transv. section x100 I:\Arc



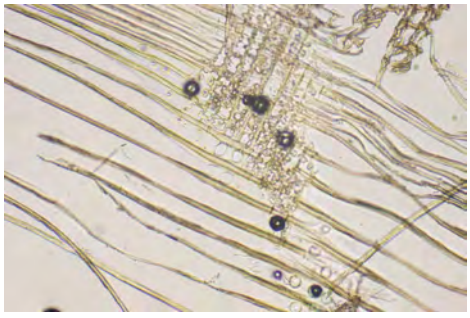
Rafter: radial section x100 I:\Arc



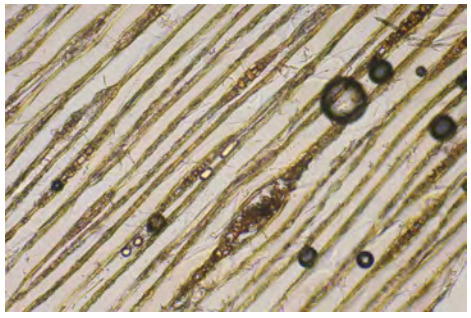
Rafter: tang. section x100 I:\Arc



Peg rafters' apex: transv. section x100 I:\Arc



Peg rafters' apex: radial section x100 I:\Arc



Peg rafters' apex: tang. section x100 I:\Arc

Air Temperature and Relative Humidity measurements See drawing THH-217C-2

Location	Location description	Date	Time	Air temperature [°]	Air relative humidity [%]
roof space	W side	17/02/2016	3:20 pm	10.4	67.3
roof space	E side	17/02/2016	3 pm	10.8	64
attic space	W side	17/02/2016	2:20 pm	10.5	60.7

attic space	E side	17/02/2016	2 pm	10.9	61.6	

Frame/Truss name non visible 13 | See drawing THH-217C-2

Missing elements | Elements with defects in critical area

Joints with decayed peg | Insect attack

Failed joints: between lower collar & N rafter | Fungi attack: S rafter

Other

Element name A south rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 12.5x9.5 | min. size (hxb) [cm]: 12.5x9 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 8 | tangential

Knots [min d/section h]: 1/13 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☐ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

Estimated causes of primary damage

Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point a

Moisture Content [%]: 16.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%]: 17.2 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%]: 16.5 | Visible Material Degradation ☐ | Not Accessible for: hygrometer ☐

Element name B north rafter

Dating: original construction | Signs of reuse

Timber treated ☐ | Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 12.2x12 | min. size (hxb) [cm]: 11.5x12 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 9 | tangential

Knots [min d/section h]: 1/11 | single | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a		
Moisture Content [%] 17.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b		
Moisture Content [%] 17.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c		
Moisture Content [%] 17.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C upper collar

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13.2x9.2 min. size (hxb) [cm] 12.5x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 3/9 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 18 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 21.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 19.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.2x10 min. size (hxb) [cm] 11x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 1.5/11 Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 16.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point d

Moisture Content [%] 17.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Frame/Truss name non visible 9 See drawing THH-217C-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 10.5x8.2 min. size (hxb) [cm]: 10x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 10 tangential

Knots [min d/section h]: 3/8 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a			
Moisture Content [%]	16.2	Visible Material Degradation ☑	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	17.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	16.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name B north rafter

Dating: original construction Signs of reuse

Timber treated ☐ Accessibilityissues: lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 10.7x7.7 min. size (hxb) [cm]: 10.5x7.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 13 tangential

Knots [min d/section h]: 2.5/7.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other: sarking broken at rafters' apex



sarking broken at rafters' apex I:\Arc

Mechanical Damage

Type Status Role

Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 19.5 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 19.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 18.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C upper collar

Dating original construction Signs of reuse
Timber treated ☐
Past interventions
Accessibilityissues
Differences compared to other elements of the same type
Section: nominal size (hxb) [cm] 11.7x7.2 min. size (hxb) [cm] 11.5x7 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 5 tangential
Knots [min d/section h] 3/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐
Other defects
Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage
Emergency interv. needed ☐
Mater.Degr. and Damage Extent
Way of identification
Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a
Moisture Content [%] 18.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b
Moisture Content [%] 19.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c
Moisture Content [%] 18.7 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.7x11.5 min. size (hxb) [cm] 11x11 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 8 tangential

Knots [min d/section h] 3/11 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 II

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a			
Moisture Content [%]	19.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	18.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	19.1	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	20.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name non visible 5 See drawing THH-217C-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other S rafter & upper collar wet

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues lower half not accessible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.2x13 min. size (hxb) [cm] 11.5x13 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 26 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	15.6	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	15.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	17.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name B north rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 12.2x10 min. size (hxb) [cm] 11.5x10 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 3 tangential

Knots [min d/section h] 4/10 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 III

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a

Moisture Content [%] 16.8 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 19.4 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 17.9 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name C upper collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11.7x8 min. size (hxb) [cm] 11x7.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 6 tangential

Knots [min d/section h] 2/12 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☑ Type Anobium Punctatum Status active

Way of identification Estimated

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role

Deformation ☐

Cracks ☐

Crushing ☐

Other ☐

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Measurement Point a

Moisture Content [%] 19.2 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Measurement Point b

Moisture Content [%] 19.3 Visible Material Degradation ☑ Not Accessible for: hygrometer ☐

Measurement Point c

Moisture Content [%] 20.1 Visible Material Degradation ☐ Not Accessible for: hygrometer ☐

Element name D lower collar

Dating original construction Signs of reuse

Timber treated ☐ Accessibilityissues only two faces visible

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 11x8 min. size (hxb) [cm] 11x8 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 2 tangential

Knots [min d/section h] 2/11.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119 I

Material degradation

Insect attack ☐ Type Status

Way of identification

Fungi attack ☐ Type Status

Way of identification

Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage Emergency interv. needed ☐

Mater.Degr. and Damage Extent

Way of identification

Estimated causes of primary damage

Poor design ☐

Poor construct. ☐

Degradation ☐ Poor maintenance ☐

Past interv. ☐

External actions ☐

Other ☐

Measurement Point a			
Moisture Content [%]	16.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	16	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	15.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point d			
Moisture Content [%]	15.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Frame/Truss name non visible 1 See drawing THH-217C-2

Missing elements Elements with defects in critical area

Joints with decayed peg Insect attack

Failed joints Fungi attack

Other all timbers very wet

Element name A south rafter

Dating original construction Signs of reuse

Timber treated ☐

Past interventions

Accessibilityissues lower half not accessible

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm] 13x8.7 min. size (hxb) [cm] 12x8.5 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location side Slope of grain [%] 7 tangential

Knots [min d/section h] 5/8.5 single Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: lower than III

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☐ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage Emergency interv. needed ☐
Mater.Degr. and Damage Extent Way of identification

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a			
Moisture Content [%]	22.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point b			
Moisture Content [%]	21.7	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point c			
Moisture Content [%]	20.3	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name C upper collar

Dating: original construction Signs of reuse

Timber treated ☐ Accessibilityissues: partly buried under masonry dust

Past interventions

Differences compared to other elements of the same type

Section: nominal size (hxb) [cm]: 13.2x9.5 min. size (hxb) [cm]: 13x9 Single piece ☑ Jointed element ☐

Strength affecting defects

Pith location: side Slope of grain [%]: 3 tangential

Knots [min d/section h] Knotty element ☐ Defects in critical area ☐ Deep checks on both sides of element ☐

Other defects

Estimated Strength Class according to UNI 11119: I

Material degradation

Insect attack ☐ Type Status
Way of identification
Fungi attack ☐ Type Status
Way of identification
Corrosion ☐ Wet surface ☑ Other

Mechanical Damage

Type Status Role
Deformation ☐
Cracks ☐
Crushing ☐
Other ☐
Estimated level of damage Emergency interv. needed ☐
Mater.Degr. and Damage Extent Way of identification



masonry dust on collar I:\Arc

Estimated causes of primary damage
Poor design ☐
Poor construct. ☐
Degradation ☐ Poor maintenance ☐
Past interv. ☐
External actions ☐
Other ☐

Measurement Point a

Moisture Content [%]	23.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	b		
Moisture Content [%]	34.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	c		
Moisture Content [%]	29.4	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Element name D lower collar

Dating: original construction | Signs of reuse:

Timber treated ☐ | Accessibilityissues: buried under masonry dust, very little visible

Past interventions:

Differences compared to other elements of the same type:

Section: nominal size (hxb) [cm]: 10.7x12 | min. size (hxb) [cm]: 9.5x12 | Single piece ☑ | Jointed element ☐

Strength affecting defects

Pith location: side | Slope of grain [%]: 7 | tangential

Knots [min d/section h] | Knotty element ☐ | Defects in critical area ☐ | Deep checks on both sides of element ☐

Other defects:

Estimated Strength Class according to UNI 11119: I



masonry dust on collar | I:\Arc

Material degradation

Insect attack ☐ | Type | Status | Way of identification

Fungi attack ☐ | Type | Status | Way of identification

Corrosion ☐ | Wet surface ☑ | Other

Mechanical Damage

Type	Status	Role
Deformation ☐		
Cracks ☐		
Crushing ☐		
Other ☐		

Estimated level of damage | Emergency interv. needed ☐

Mater.Degr. and Damage Extent | Way of identification

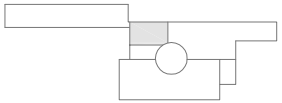
Estimated causes of primary damage

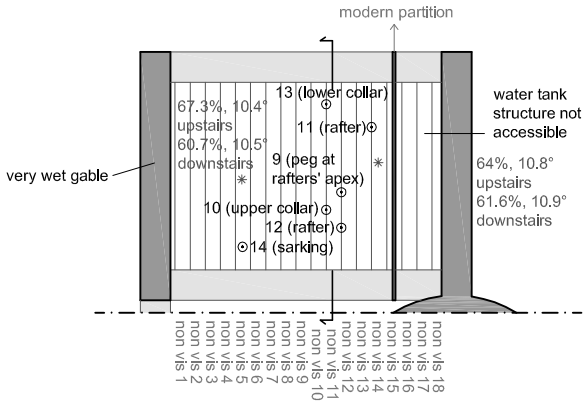
Poor design ☐ | Poor construct. ☐ | Degradation ☐ | Poor maintenance ☐ | Past interv. ☐ | External actions ☐ | Other ☐

Measurement Point	a		
Moisture Content [%]	33.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	b		
Moisture Content [%]	26	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	c		
Moisture Content [%]	24.9	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐
Measurement Point	d		
Moisture Content [%]	28.5	Visible Material Degradation ☐	Not Accessible for: hygrometer ☐

Plan 1:200

- ✳ air humidity and temperature
- ⊙ timber samples for species identification







Sections looking West 1:100

Visual inspection:
many small knots & diffuse insect exit holes on most timbers

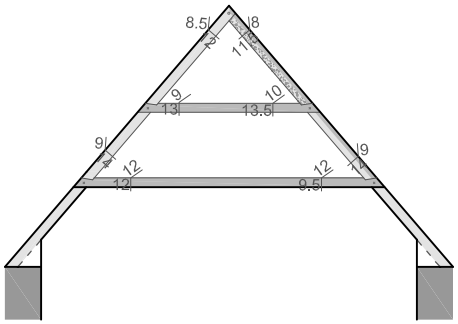
- open joint
- x:x element name : estimated strength class (na=less than 2 faces visible)
- wet surface
- fungl attack
- Insect attack

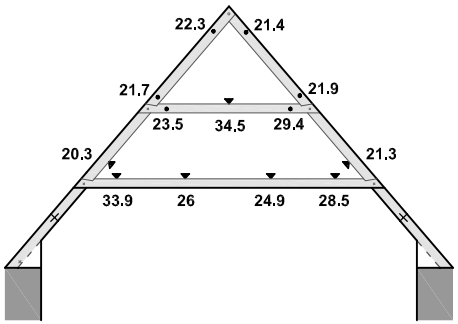
Moisture content readings:

- lower/upper/lateral face
- visible face
- rear face
- × not accessible

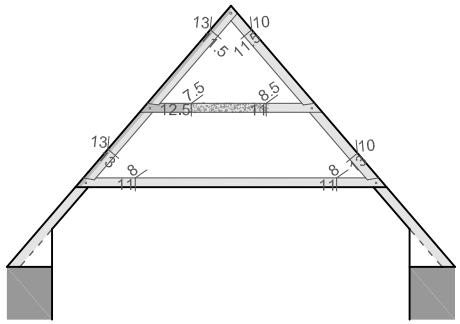
readings <18
readings >18
readings >20

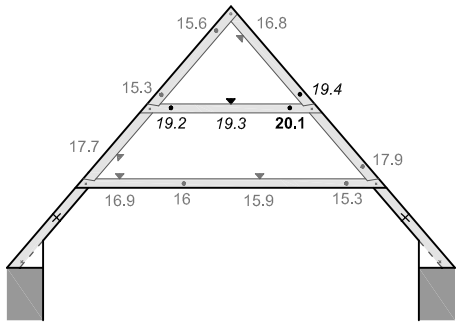
Frame non vis 1



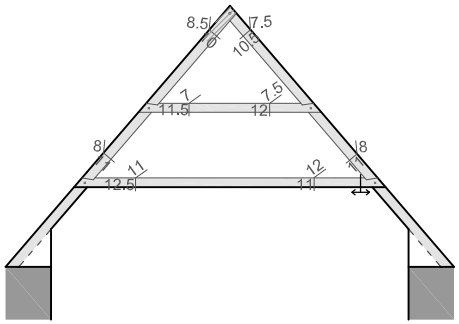


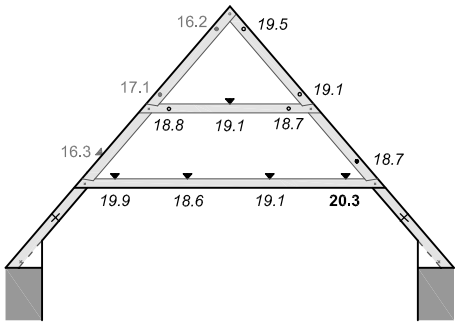
Frame non visible 5



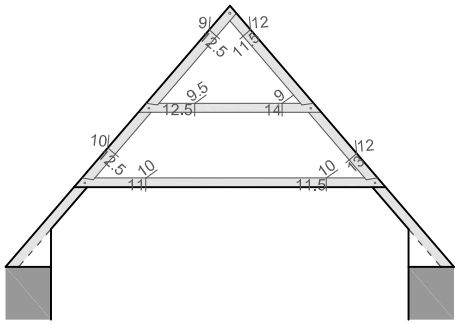


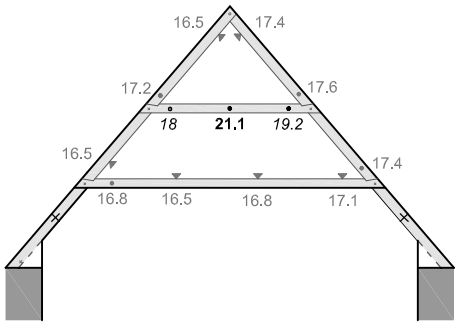
Frame non visible 9





Frame non visible 13







APPENDIX G

CONSULTED ARCHIVAL DOCUMENTS RELATED TO SEVENTEENTH- AND EIGHTEENTH-CENTURY TIMBER WORK OR WRIGHTS

ECA SL34/4/2 1706-1774. St Mary's Chapel Incorporation apprentices book. Edinburgh City Archives.

ECA SL 34/1/7 1740-55. St Mary's Chapel Incorporation record 1740-1755. Edinburgh City Archives.

ECA SL 34/4/1 1706-74. St Mary's Chapel Incorporation apprentices book 1706-1774. Edinburgh City Archives.

EUL LAII87/1A 1684-7. Holyroodhouse, Stirling Castle, Dumbarton Castle, Edinburgh Castle Vouchers of expenditures on works (1684-87). Edinburgh University Library.

EUL LAII87/2 1684-5. Repairing Holyroodhouse for reception of the High Commissioner (8 vouchers). Edinburgh University Library.

EUL LAII87/3 1685. Timber for Holyroodhouse (1 voucher). Edinburgh University Library.

EUL LAII87/6 1684-6. Wright work at Holyroodhouse and Stirling Castle (4 vouchers, 1684-6). Edinburgh University Library.

EUL LAII87/7 1686. Timber for Holyroodhouse and fees of carvers (4 vouchers, 1686). Edinburgh University Library.

EUL LAII87/8 1684. Works at council chamber, privy chamber and oratory at Holyroodhouse (2 items). Edinburgh University Library.

EUL LAII88/1/1 1733-4. Accompt of Carpenter work performed at the Abbay of Holyroodhouse by Robert Mowbray wright 1733-4. Edinburgh University Library.

EUL LAII88/1/8 1733-4. Accompt of large tree beams furnished to the roof of Holyrood 1733-4. Edinburgh University Library.

EUL LAII88/2 1735-6. Accounts of several artificers employed in repairing Holyroodhouse 1733. Edinburgh University Library.

EUL LAII88/3 1721-1805. Note of money paid for repairs on Holyroodhouse since the union (1721-1806). Edinburgh University Library.

GH DRAWING 1908. George Heriot's School. Proposed additional class rooms. Uncatalogued plan and sections showing the roof of the East and West ranges.: Private archive at George Heriot School.

GH REPORTS 1997. Reports on repair works carried out on the roofs of George Heriot Hospital. Private archive at George Heriot School.

HES CONDITION REPORT 1999. Uncatalgued report on Pinkie House condition survey. Historic Environment Scotland.

HES LETTER BY RENTOKIL 1973. Uncatalogued letter from Rentokil (Ratsouris Scotland Ltd) detailing proposed insecticidal treatment of main roofspace at Pinkie House and provision of a thermal quilt (July 1973). Historic Environment Scotland.

HES REPORT BY ADAMS 1954. HES uncatalogued technical report by Adams W R. Histioric Environment Scotland.

ML SHANKS 152/T6 1955. Survey of the Trades House of Glasgow and alterations by Wylie Shanks Architects *Wylie _Shanks Architects.* drawings ed.: Mitchell Library, Glasgow City Archives.

ML T-TH 1/1/7 1787-98. Trades House: docquetted minute book and Collectors' Accounts, Feb 1787 - 17 May 1798. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/1/12 1853-65. Trades House: docquetted minute book and Collectors' Accounts, 13 Oct 1853 – 8 Sep 1865. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/8/2 1855-7. Accounts of the Trades House. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/17/1 1791-98. Copies of Trades House Accounts in MSS 1711 – 1713, 1720 – 1817 and abstracts of same. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/34/1 1791-2. Estimates for building and plasterwork by masons, wrights and plasterers. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/34/3 Undated. The ceiling of the great hall in Glasgow Trades Hall. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/34/4 1878-83. New buildings proposed in 1883 & report of the building committee in 1878. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/40/7 Undated. The Craig family of Glasgow. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/97/2 1877. New design for Glasgow Trades Hall proposed by architects James Salmon and Son. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 1/97/3 1931. Plans and section of Glasgow Trades Hall by John Laird. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 5/19/15 1791. James Jaffray designs for the Trades Hall 8th June 1791. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 5/19/16 1792. Minutes of Building Committee 26th January 1792. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 5/19/17 1792. Minutes of Building Committee 10th March 1792. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 5/28/7 1795. Incorporation of Weavers: new tenement in Weaver Street – estimate for wright work by John Brown for the building proposed to be erected, 1 April 1795. Mitchell Library, Glasgow City Archives.

ML T-TH 9/4/2 1731-1811. Incorporation of Wrights: membership roll, 1731 - 1811. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

ML T-TH 9/4/3 1811-70. Incorporation of Wrights: membership roll, 1811 - 1882. *Glasgow Trades House.* Mitchell Library, Glasgow City Archives.

NLS ACC 70/56 1711-33. Box 1: Miscellanea from St Mary's Chapel Incorporation. National Library of Scotland.

NLS MS1646 Z.02/18A 1719. Stirling Castle, November 1719, plan and sections of the Palace, Jelfe Andrews (Architect) and Moore Thomas (Engineer) *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS1646 Z.02/18B 1719. Stirling Castle, November 1719, plan and sections of the Great Hall, Jelfe Andrews (Architect) and Moore Thomas (Engineer) *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS1646 Z.02/18D 1719. Stirling Castle, November 1719, plan and sections of ancillary buildings (chapel, powderhouse, ...), Jelfe Andrews (Architect) and Moore Thomas (Engineer) *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS1646 Z.02/47A 1752. Plan Elevation and Section of the Guard House in the Ravelin at Fort George, 1752, No.3. By William Skinner (engineer) and Charles Tarrant (draughtsman). *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS1646 Z.02/50A 1753. Plan and Elevations with Sections of the Barracks for 1600 Men and Officers Fort George. By William Skinner (engineer) and Charles Tarrant (draughtsman). *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS1646 Z.02/50B 1754. Plan Elevations and Sections of the North Pile of Barracks Shewing how High they were rais'd in the Year 1754. By William Skinner (engineer). *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS1647 Z.02/55A 1762. Plan Elevation and Sections of the Store-House for Provisions, and Barrack-Masters Stores 1762 by William Skinner (Engineer). *Military Maps of Scotland (18th century).* National Library of Scotland.

NLS MS10694 1757-9. Board of Ordnance account book for Fort George. National Library of Scotland.

NLS MS14493/37 1660. Transcription by Aonghus Mackechnie of works at Holyroodhouse. National Library of Scotland.

NLS MS14493/38 Undated. Transcription by Aonghus Mackechnie of account of materials left at Holyroodhouse. National Library of Scotland.

NLS MS14551/22 1729. Contract between W. Adam and the Marques of Tweeddale for works at Yester. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/24 Undated. Contract between W. Adam and the Marques of Tweeddale for works at Yester. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/109 1742-49. Contract between W. Adam and the Marques of Tweeddale for works at Yester. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/112 1742-48. Account of timber furnished by William Adam for Yester House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/115 1750. Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/116 1750. Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/126 1753. Letter from John Adam to the Marquess of Tweeddale. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/128 1753. Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/130 1750. Account of repairs done by John Adam probably at Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14551/137 1755. Letter from John Adam to the Marquis of Tweedale probably regarding Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14637 1667-75. Account of work by James Baine for the Marquis of Tweeddale at Tweeddale House, Yester House and Pinkie House. National Library of Scotland.

NLS MS14665 1750-6. Accounts by Thomas Dunlop for repairs to Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14680 1779-82. Works at Tweeddale House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS14716 1768-78. Repairs to roofs at Pinkie House. *Hay of Yester Papers.* National Library of Scotland.

NLS MS25783/77 1710. Transcription by Joe Rock of payments to various wrights for work at Newhailes House. National Library of Scotland.

NLS MS25783/144 1717. Transcription by Joe Rock of payment to John Young wright for work at Newhailes House. National Library of Scotland.

NLS MS25791/95 1720-1. Transcription by Joe Rock of payments to various builders for works at Newhailes House. National Library of Scotland.

NLS MS25818/42 1720. Account of John Young wright 1720. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25818/49 1721. Account of Andrew Cuthbertson slater 1721. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25818/50 1718. Account of John Young wright 1718. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25833/222 1709. Transcription by Joe Rock of account of work at Newhailes House by Edward Isaac wright. National Library of Scotland.

NLS MS25834/9 1710. Transcription by Joe Rock of account of stones furnished by John Young wright for Newhailes House. National Library of Scotland.

NLS MS25834/36 1710. Transcription by Joe Rock of account of work at Newhailes House by Edward Isaac wright. National Library of Scotland.

NLS MS25834/110 1711. Transcription by Joe Rock of account of work at Newhailes House by Edward Isaac wright. National Library of Scotland.

NLS MS25834/113 1711. Transcription by Joe Rock of account of deals furnished by James Sutherland merchant for Newhailes House. National Library of Scotland.

NLS MS25834/117 1711. Transcription by Joe Rock of account of deals furnished by James Sutherland merchant for Newhailes House. National Library of Scotland.

NLS MS25834/139 1711. Transcription by Joe Rock of account of work at Newhailes House by Edward Isaac wright. National Library of Scotland.

NLS MS25835/82 1715. Transcription by Joe Rock of account of work at Newhailes House by John Young wright. National Library of Scotland.

NLS MS25836/43 1719. Transcription by Joe Rock of account of work at Newhailes House by John Young wright. National Library of Scotland.

NLS MS25836/87 1719. Transcription by Joe Rock of account of slates furnished by Patrick Stewart for Newhailes House. National Library of Scotland.

NLS MS25836/206 1719. Transcription by Joe Rock of account of lead furnished by Joseph Forester for Newhailes House. National Library of Scotland.

NLS MS25836/208 1721. Transcription by Joe Rock of account of work at Newhailes House by John Young wright. National Library of Scotland.

NLS MS25836/224 1720. Transcription by Joe Rock of account of timber furnished by George Mackenzie for Newhailes House. National Library of Scotland.

NLS MS25836/236 1721. Transcription by Joe Rock of account of timber furnished by Thomas Curie for Newhailes House. National Library of Scotland.

NLS MS25836/237 1721. Transcription by Joe Rock of account of timber furnished by James Craig for Newhailes House. National Library of Scotland.

NLS MS25837/15 1722. Account of timber furnished by John Young wright for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/35 1722. Account of timber furnished by John Young wright for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/43 1721. Transcription of Joe Rock of account of work at Newhailes House by John Young wright. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/53 1722. Account of deals furnished by John Wilson for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/55 1722. Account of deals furnished by John Wilson for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/75 1722. Account of timber furnished by John Young wright for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/78 1722. Account of timber furnished by John Young wright for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/81 1722. Transcription of Joe Rock of account of timber for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/88 1721-2. Account of work at Newhailes House by John Young wright. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/101 1722. Transcription by Joe Rock of account of work at Newhailes House by John Young wright. National Library of Scotland.

NLS MS25837/109 1722. Account of timber furnished by John Young wright for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/131 1722. Transcription of Joe Rock of account of timber furnished by John Wilson for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/140 1723. Transcription of Joe Rock of account of work at Newhailes House by John Wilson. *Newhailes Estate Papers.* National Library of Scotland.

NLS MS25837/157 1723-4. Account of timber for Newhailes House. *Newhailes Estate Papers.* National Library of Scotland.

NRS CS96/2243 1736-47. Account book of Thomas Dunlop, wright, Edinburgh, 1736-1747, Court of Session processes. National Records of Scotland.

NRS DGD124/15/216/2 1701. Letter to the Earl of Mar from the Marquis of Annandale. Annandale has urged the Lords of Treasury to do something for the Castle of Stirling - 11 Apr [1701]. National Records of Scotland.

NRS E36/30 1671-1678. Sir William Bruce of Balcoskie: Holyrood, Stirling, Edinburgh, the Bass, 4 Mar. 1671-8 Jan. 1674, rendered 9 July 1674. National Records of Scotland.

NRS E37/24 1682. Estimate of materials required for reparation of Holyroodhouse, with notes of unfinished rooms their work to be done by Robert Mill under contract and of buildings and repairs necessary at Stirling Castle (1682). National Records of Scotland.

NRS E37/33 1699-1703. Duplicate account of work in Stirling Castle, bearing copy treasury warrant discharging Earl of Mar for sums required (1699-1703). National Records of Scotland.

NRS E661/107 1681. Forfeited Estates: Winton: Estater papers and vouchers prior to forfeiture: Accounts for timber bought for the Earl of Winton by David Balfour, his chamberlain (1681). National Records of Scotland.

NRS E661/107 1681. Forfeited Estates: Winton: Estate papers and vouchers prior to forfeiture: Accounts for timber bought for the earl of Winton by David Balfour, his chamberlain, 1681. National Records of Scotland.

NRS GD29/92 1671. Warrant by the Lords Commissioners of the Treasury to Sir W. Bruce of Balcaskie as Surveyor General to repair the roof and alleyways at Sterling Castle, provide for wright and glass-work of the rooms there (1671). National Records of Scotland.

NRS GD29/94 1679. Contract between Sir William Bruce of Balcaskie, Surveyor General, Sir William Sharpe of Stainiehill, the King's Cash-keeper, and Robert Mylne, the King's Master Mason, for the building and repair of Halyrudehouse (1679). National Records of Scotland.

NRS GD29/95 1673. Warrant by the Lords Commissioners of the Treasury to Sir William Bruce of Balcaskie, as Surveyor General to repair the Lord Chancellor's and the Duke of Hamilton's lodgings in Holyrudhous. Signed by the Lord Commissioners - 6/8/1673. National Records of Scotland.

NRS GD29/100 1678. Two copies of an order signed by Lauderdale terminating Sir William Bruce's appointment as Surveyor General, the building and repairing of Holyrudhouse [Holyroodhouse, Edinburgh] being completed - 30 May 1678. National Records of Scotland.

NRS GD45/18/1616/21 1694. Contracts between James, Earl of Panmure, and James Baine, the King's Master

Wright, for mason, wright, plaster and stone work at Brechin Castle. Petition by Baine defending his work. National Records of Scotland.

NRS GD45/18/1616/25 1694. Contracts between James, Earl of Panmure, and James Baine, the King's Master Wright, for mason, wright, plaster and stone work at Brechin Castle. Additional artickles of work done by Ja:baine (consented to) att brechin Castle and valued by Tobias bauchop november 1694. National Records of Scotland.

NRS GD124/11/37 1687. Letter to the Earl of Mar from the Privy Council, authorising him to repair roof etc of Stirling Castle. National Records of Scotland.

NRS GD124/15/207/3 1700. Letter to the Earl of Mar from the Earl of Seafield. Difficulty in obtaining money to repair Stirling Castle - 9 Apr 1700. National Records of Scotland.

NRS GD124/15/216/2 1701. Letter to the Earl of Mar from the Marquis of Annandale. Annandale has urged the Lords of Treasury to do something for the Castle of Stirling - 11 Apr [1701]. National Records of Scotland.

NRS GD124/15/471 1707. Letter to the Earl of Mar from Mr James Smith, surveyor of Her Majesty's works, in Edinburgh. He describes the dismal state of the Palace of Holyroodhouse and the Castle of Stirling (1707). National Records of Scotland.

NRS GD124/15/506/23 1707. Letter to the Earl of Mar from the Earl of Glasgow. Sensible of Mar's diligence in the above matter. Payment made for repair of Stirling Castle - 19 Jun 1707. National Records of Scotland.

NRS GD124/15/567 1707. Letter to the Earl of Mar from Col John Erskine, his step-father, at Alloa. Family matters. Negotiations with Balgowan. Repairs to Stirling Castle necessary - 16 May 1707. National Records of Scotland.

NRS GD421/5/2 1633-42. Records of George Heriot's Trust, Edinburgh, Accounts and other Financial Papers of George Heriot's Hospital and Trust, Treasurer's accounts. National Records of Scotland.

NRS GD421/5/3 1642-52. Heriot’s Hospital Treasurer’s Accounts 1642-1652. National Records of Scotland.

NRS GD421/5/4 1652-69. Heriot’s Hospital Treasurer’s Accounts 1652-69. National Records of Scotland.

NRS GD421/10/68 1685. Detailed account and discharge by Thomas Sandilands, wright, to the treasurer of George Heriot's Hospital for £683 Scots for timber and wright work performed on the chapel and lodge (or summer house) in the Easter garden, 16 Jan 1685. *Records of George Heriot's Trust, Edinburgh, Administrative records of Heriot's Hospital and school statutes, foundationers, staff building, housekeeping.* National Records of Scotland.

RCAHMS DP 043860 1959. Neidpath Castle Digital copy of west elevation and section looking East and North elevation and section looking South. Copy of PBD 258/19.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS DP 043862 1964. Neidpath Castle Reconstruction drawing: first floor plan. Copy of PBD 258/29.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS DP 055037 1891-2. Sections through quadrangle including interior elevations of chapel, dining hall and classrooms. Title: 'GEORGE HERIOT'S HOSPITAL EDINBURGH'. Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS DP 143824 2012. Oblique aerial view of Drochil Castle, looking to the E. *RCAHMS Aerial Photography Digital.* Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS DP 161383 2013. Darnaway Castle. Ground floor. Hall. Hammerbeam roof.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS DP 222837 2015. Oblique aerial view of Darnaway Castle, looking NE. *RCAHMS Aerial Photography Digital.* Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS DPM 1940/110/4 1948-52. Heating plans. Plans and details of West wing affected by dry rot. Plans, sections and details of roof.: Royal Commission on the Ancient and Historical Monuments of

Scotland.

RCAHMS LOR/M/17/5 1953. Plans and elevations showing additions and alterations. Details showing new floor to painted gallery. Details showing roof over painted ceiling and catwalk.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS LOR/T/1/5 1928. Plans, sections and elevations of verandah, repairs to North wing roof and coal cellar. Plans and sections of new drive and forecourt. Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS MLD 69/29 1947. Pinkie House. Section and elevations. Copies C 39421 P, C 39421 S.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS SC1202662 Undated. Dundee, Claypotts road, Claypotts Castle. View of plans of castle. Copy of A 50130.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS SC1324316 1971. Dundee, Claypotts road, Claypotts Castle. General view of angle tower. Copy of G 81173 S.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS SC 383456 1970. Torthorwald, Cruck-framed Cottage. Interior. General view, Copy of DF 1112 *Historic Buildings and Monuments/Scottish Development Department photographs.* Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS SC 433080 1998. Darnaway Castle. Photographic copy of drawing showing part view and plan of the timber framed roof of the Great Hall. Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS SC 738897 1959. Stirling, St John Street, Church Of The Holy Rude. View of the timber roof of nave.: Royal Commission on the Ancient and Historical Monuments of Scotland.

RCAHMS SC 767049 1995. Hopetoun House, interior. View of hay loft in stables. Digital image of C 64180. Royal Commission on the Ancient and Historical Monuments of Scotland.

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APPENDIX I

PAPERS PUBLISHED BY THE AUTHOR RELATED TO THE PHD RESEARCH

SERAFINI, A. & GONZALEZ LONGO, C. 2015a. The design and construction techniques of eighteenth century timber roofs in Scotland: Glasgow Trades Hall and Tweeddale House in Edinburgh. *In:* BOWEN, B., FRIEDMAN, D., LESLIE, T. & OCHSENDORF, J. (eds.) *5th International Congress on Construction History.* Chicago.....1123

SERAFINI, A. & GONZALEZ LONGO, C. The Roof Structure of George Heriot's Hospital Chapel and the Roof Design of its period in Scotland (in review). The architecture of Scotland in its European setting: 1660-1750, 2015b Edinburgh.....1131

SERAFINI, A. & GONZALEZ LONGO, C. Seventeenth and eighteenth century timber roof structures in Scotland: design, pathologies and conservation. *In:* VAN BALEN, K. & VERSTRYNGE, E., eds. 10th International Conference on Structural Analysis of Historical Constructions, 2016 Leuven. Taylor and Francis. 1144

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THE DESIGN AND CONSTRUCTION TECHNIQUES OF EIGHTEENTH CENTURY TIMBER ROOFS IN SCOTLAND: GLASGOW TRADES HALL AND TWEEDDALE HOUSE IN EDINBURGH

Anna Serafini[1], **Cristina González-Longo**[2]

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Scotland, Timber, Roofs, Structures, Eighteenth Century, Wright

Abstract

The few open roofs mentioned in literature seem to represent an exception rather than the rule: most Scottish timber roofs are hidden behind timber or plaster ceilings and characterised by a much simpler common rafter form. From the eighteenth century onwards they presented hipped and trussed arrangements as well as other more complex solutions developed to meet the requirements of evolving architecture. This paper attempts to shed some light on the design and construction techniques of eighteenth century Scottish timber roofs with the preliminary results obtained from the creation of a relational database of 1250 buildings (including structures, professionals, dates), related mapping, survey of 29 roofs across Scotland and a more detailed study of those at Tweeddale House in Edinburgh, and Glasgow Trades Hall. Both buildings have roofs from the period in which the Adam brothers worked on them as architects. The original sixteenth century Tweeddale House was remodeled by the Adams in 1752-3 and almost forty years later Robert Adam designed the Glasgow Trades Hall (1791/4), although the building was completed after his death with a modified design. Archival research combined with surveys has allowed to make an initial appraisal of the design and construction processes involved in the two projects. Many questions arise concerning the specific involvement of architects and wrights in the successive transformations of the roofs and an attempt to identify local and foreign influences has been carried out by analyzing the typology of roofs and joints.

[1] Department of Architecture, University of Strathclyde, 75 Montrose street Glasgow, anna.serafini@strath.ac.uk

[2] Department of Architecture, University of Strathclyde, 75 Montrose street Glasgow, c.gonzalez-longo@strath.ac.uk

INTRODUCTION

Scottish roof structures seem to have been a neglected area within the construction history studies. Emerging research (Hanke 2006, Newland 2010, Crone and Mills 2012) has started to shed some light, although it is still fragmented. The main focus so far has been on spectacular open structures (Stell and Baillie 1993) or on roof structures up to 1647 in a restricted geographical area (Hanke 2006).

Our ongoing research considers a more comprehensive geographical area (Scotland) and chronological period (seventeenth and eighteenth centuries). This paper presents some initial results on the design and construction techniques of eighteenth century Scottish timber roofs. From an extensive relational database of 1250 buildings, a selection of 29 groups of buildings has been surveyed throughout Scotland. From these, Tweeddale House in Edinburgh, and Glasgow Trades Hall, both with a distinctive construction phase by the Adam family, have been identified as suitable case studies to start understanding the origin, development, influences and authorship of Scottish roof structures.

SEVENTEENTH CENTURY TIMBER ROOFS IN SCOTLAND

Although the evidence for medieval Scottish carpentry is scarce, the few surviving roofs seem to testify Scotland was aligned with the English tradition of hammer-beam roofs (Hanke 2006). From the sixteenth century onwards, as suggested by Hanke and confirmed by our own surveys, most Scottish roofs are gabled with a simple, closely spaced, common rafter form and their structure is hidden behind timber or plaster ceilings. They are A-shaped frames of square uniform scantling with no distinction between principal and common rafters. There is absence of wall-plates, tie-beams and purlins. The longitudinal rigidity is assured by the gable walls and the sarking: two layers of sawn deals that run horizontally and vertically and comprise in-between a sort of fleece for insulation. Additional rigidity is sometimes provided by the rafter foot whose ashlar post is extended downward on the masonry. Joints are mortice and tenon, or lapped. Dovetail joints appeared in Scotland only by the end of the seventeenth century.

This common rafter form is part of the Romanesque Northwest European school of carpentry. The use of sarking and the rafter foot, and the absence of wall-plates and purlins, are nevertheless distinctive Scottish features (Hanke 2006). Remarkably, this characteristic common rafter form is found in Scotland up to the eighteenth century, whilst side purlins and queen/king struts in England (Hewett 1980) and trestle-based structures in Continental Europe (Ostendorf 1908, in Hanke 2006) had already been introuced since the thirteenth century.

THE INTRODUCTION OF THE TRUSSED ROOF IN SCOTLAND

Before classical architecture became the norm in Britain, both English and Scottish wrights (carpenters) understood timber elements in roofs as behaving in compression and refrained from using tension-absorbing elements to counteract the tie-beam deflection, as was instead common practice in Italy (Valeriani 2005). With the introduction of classical architecture in England by Inigo Jones (1573-1652) hipped roofs, mansard roofs, domes and other complex arrangements started being used. Gable walls disappeared and roofs had to be shallower and cover bigger spans; local traditional roofing methods became inadequate and the trussed roof had to be adopted (Yeomans 1992). The simpler trussed roof form, the king-post truss, has a central vertical element suspended from the apex of the 'timber arch' formed by the principal rafters; in this way the post acts as a tie and supports the tie-beam, preventing its deflection. Whilst the first English

trussed roofs can be seen in Jones' buildings, Sir Christopher Wren's later designs were undoubtedly the most innovative and influential (Yeomans 1992). They were both influenced by Italian treatises (Valeriani 2006).

Classical architecture arrived in Scotland in the seventeenth century with Sir William Bruce and James Smith who built the first hipped and mansard roofs but still using common rafter roofs. Since they often remodeled old buildings, they benefited from intermediate spine walls reducing the roof span, as in Holyrood Palace (1671-9) or Dalkeith House (1702-11). The first known drawing of a trussed roof for a Scottish building is the 1720's William Adam's New College Library in Glasgow (Hanke 2012) with a simple king-post roof (fig. 1). The joggles shown at the top and base of the king-post can also be found in English roofs of the period (Yeomans 1992). Joggles are shown in some Italian treatises: 1449 Mariano di Jacopo (Barbisan and Laner 2003) and 1600 Serlio. Since William did not visit London until 1727, it is likely that his reference was the copy of Serlio's treatise he owned (Rowan 1990), which illustration also shows the post dovetailed in the tie-beam (fig. 2). Unfortunately the building has now disappeared so it is not possible to see if this design was realised. Other of Adam's buildings of the period, such as Duff House (1735-40) and Arniston House (1726-33), do not have trussed roofs. This brings to the hypothesis that Adam's design intention to build trusses clashed with the lack of familiarity of local wrights with these emerging structures.

The earliest trussed roofs we have identified so far in Scotland are Oakshaw Trinity church in Paisley (1754-6), a queen-post roof (approx. 20m), whose arrangement suggests an inspiration from Wren's St Michael's Paternoster Royal (1690), and Auchinleck House (1755), a king-post roof (approx. 10m) with a curious 'bulb' shape at the top of the post (fig. 6).

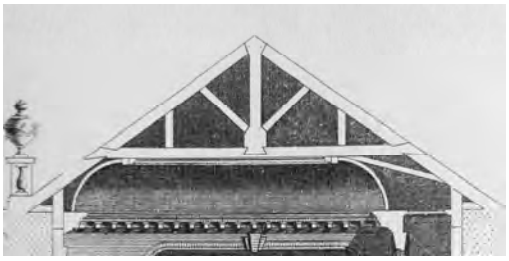


Figure 1: W. Adam's design for the Glasgow New College Library, 1720 (Adam 2011)

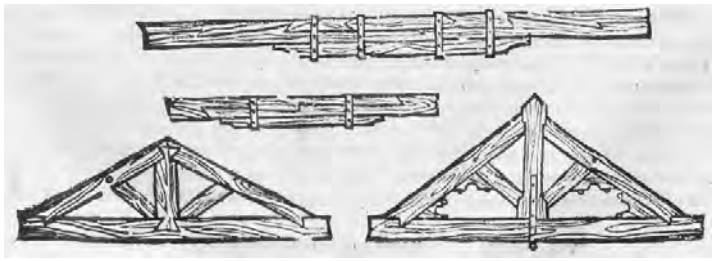


Figure 2: A post with joggles and a post dovetailed in the tie-beam as shown in Serlio (1600)

Common rafter roofs anticipating the trussed system: Tweeddale House in Edinburgh

The introduction of the trussed system in Scotland was slow and gradual: many eighteenth century roofs still show a common rafter form. A good example is Tweeddale House's roof. The house was built in sixteenth century as a small rectangular single pile mansion, with a projecting stair tower, and around 1600 it was extended to the north, transforming it into a double pile (Gifford 1984). Throughout the seventeenth century it was renovated and in 1750-6 the 4th Marquess of Tweeddale commissioned its reconstruction to John and Robert Adam (Gifford 1984). Deacon Thomas Dunlop, who had previously done other works for the Marquess (NRS CS96/2243), was the wright and contractor. The roof was completely dismantled and rebuilt (NLS MSS.14665). Some repair works were done later in 1779-82 (NLS MSS.14680) and in 1791 the house was extended to the west (fig. 3).

Although only partly visible today we can appreciate that the structure is the one reconstructed by Dunlop in 1750-6. Additional rafters (fig. 3, f) have been later added on top of it, perhaps

as part of the 1779/82 works to stop water ingress from damaging the bottom part of Dunlop's rafters, which had in fact to be substituted with prosthesis during the works in 1980s.

Tweeddale's roof retains many features of seventeenth century common rafter roofs. The pitch is steep (40°) compared to contemporary trussed roofs, such as Oakshaw Trinity church (34°) (fig. 4). The frames are very closely spaced (50cm max) and they do not have tie-beams nor wall-plates, like in Balcaskie House (1668). Though the span is quite wide (11.4m), due to its double pile configuration, a spine wall reduces it to 6.2m, just like in Holyrood Palace (1671).

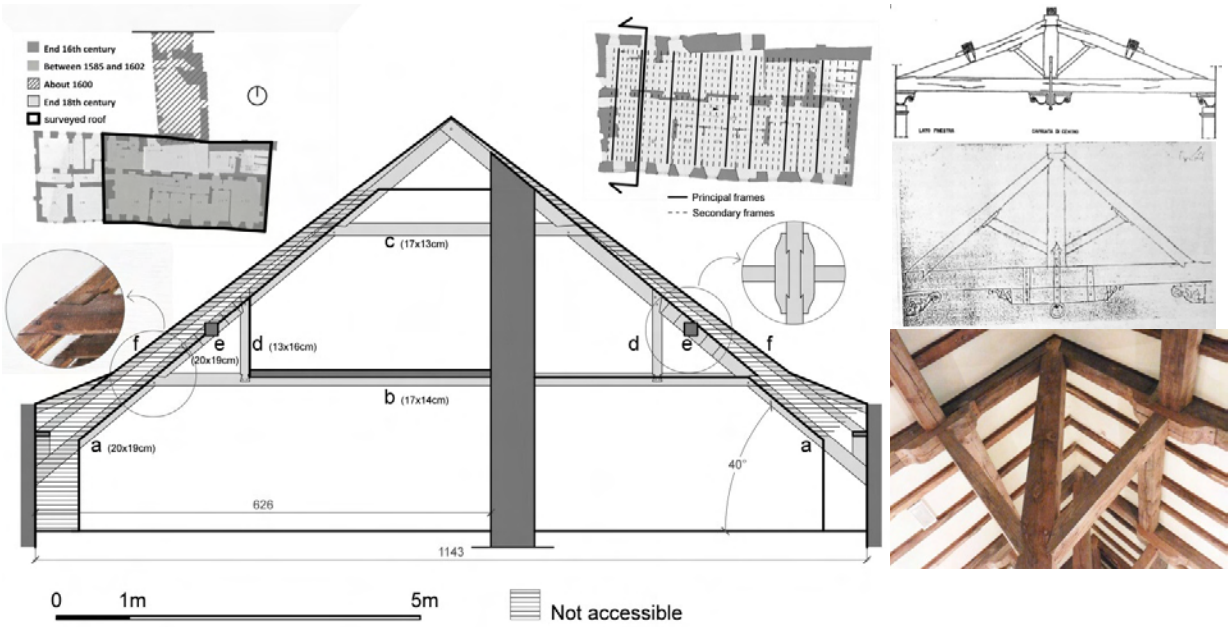


Figure 3: On the left the transversal section of Tweeddale house roof structure with reference plan (Anna Serafini); on the right from top to bottom cleats used in church of Sant'Agata di Mugello in Scarperia, Florence (Tampone 2001), a truss drawn by Mariano di Jacopo (1449 in Munafò 2002), Brodie Castle Stables (Anna Serafini)

Other features of the roof anticipate the emerging trussed system. The frames are divided in principal and secondary frames. Two purlins (fig. 3, c), one on each side, connect the principal frames together: they are tenoned in cleats (fig. 3, d) that are in turn dovetailed on the sides of the rafters to reinforce their section where the purlins abut. Whilst purlins are normally employed in trussed roofs, cleats seem to be a more common feature in Italy, in both buildings and treatises (fig. 3). In Scotland we have identified them also in Oakshaw Trinity church and in Brodie Castle stables (end 18C) (fig. 3). Other interesting features are the two vertical struts (fig. 3, e), one on each side, hanging from the rafters and giving additional support to the raised tie-beam. These tension-absorbing members suggest an awareness of the problem of beam deflection, and can be seen as an antecedent of king/queen-posts (Hanke 2008). They appear also in Stirling Castle Palace (Hanke 2008 suggests beg. 18C) and Newhailes House (1730). However, the solution does not show a full understanding of their role as they create additional load on the rafters. The use of dovetail joints shows awareness that the jointed elements act in tension.

We do not know who designed this roof. John and Robert Adam, the architects in charge, were also working at Yester House for the Marquess at the time (Dunbar 1972) and this could explain why Dunlop had a wider commission in the building, as wright and masonry contractor (NLS MSS.14665). Dunlop had been apprentice to John Montgomery in Mary's Chapel, the incorporation of masons and wrights, from 1700 to 1711 (ECA SL 34/4/2). He was probably one

of the foremost wrights in Edinburgh at the time: he was Deacon of the incorporation and had eight apprentices through his life (ECA SL 34/4/2). The exact role of wrights in Scottish projects at the time needs further research. The word 'wright' has disappeared from English construction vocabulary, superseded by 'carpenter' (for heavier structural work) and 'joiner' (for furniture and fittings). The Oxford English Dictionary defines 'wright' as a generic "constructive workman" or "one who deals with wood, a carpenter, a joiner". In fact wrights in Scotland used to deal with all the timber work, from roofs, to flooring, to windows, furniture, etc., and started working as contractors in the seventeenth century (Dunbar 1976, Newland 2010), just like carpenters in England (Yeomans 1992). Their role was increasingly important in the construction site, and they outnumbered masons in the incorporation (ECA SL 34/4/2). It is therefore reasonable to think that in case of minor works, such as Tweeddale House, the roof structure was both designed and built by Dunlop.

Scottish trussed roofs: Glasgow Trades Hall

The brothers Adam's earliest trussed roofs known in Scotland are in Fort George: the Museum and Staff block (1762), the Ordnance Store (1759/61) and the Chapel (1763) (fig. 4). In all of them, the purlins are misplaced as they should be where the struts meet the rafters, in order to avoid additional load. Again it is not easy to conclude who might have designed these roofs. At the time only John was in Scotland, Robert, James and William were in London. William had died in 1748 but he may have brought skilled English carpenters from his London trip. Lewis (2006) noted that in 1760s-70s his son Robert hired men in London whose names are found in the Edinburgh New Town ten years later. Another possible source could have been Price's new treatise (1733) at the Adams' library (Rowan 1990). This could explain the misplaced purlins, since Price never showed the purlins' location in his drawings.

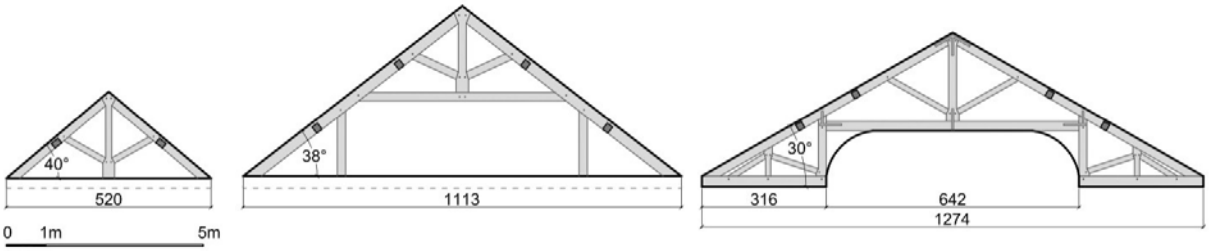


Figure 4: Roofs at Fort George, from left to right: Staff block (1762); Ordnance Store (1759/61); Chapel (1763) (Anna Serafini); the graphic scale relates to all drawings.

Further considerations can be made by comparing Robert Adam's design for Glasgow Trades Hall (1791-4) with the structure built after his death in 1792 (fig. 5). Adam's design was chosen by the Trades Incorporations in 1791 through an invited competition between him, James Jaffray and John Craig (GCA T-TH 1/1/7). The extra land required for Adam's additional lateral wings was never bought: the design for a building ca. 33.5m long had to be adapted to a plot only 30.5m long. If we compare Adam's drawings with the present structure (fig. 5) we can see the overall proportions distorted and the diameter of the dome dramatically decreased (Sutherland 2005). After Robert's death, the wright John Brown was appointed contractor under the supervision of James and William Adam (GCA T-TH 1/1/7) who did not seem to have been involved in the design process. It seems therefore reasonable to think Brown took on a leading role in the works.

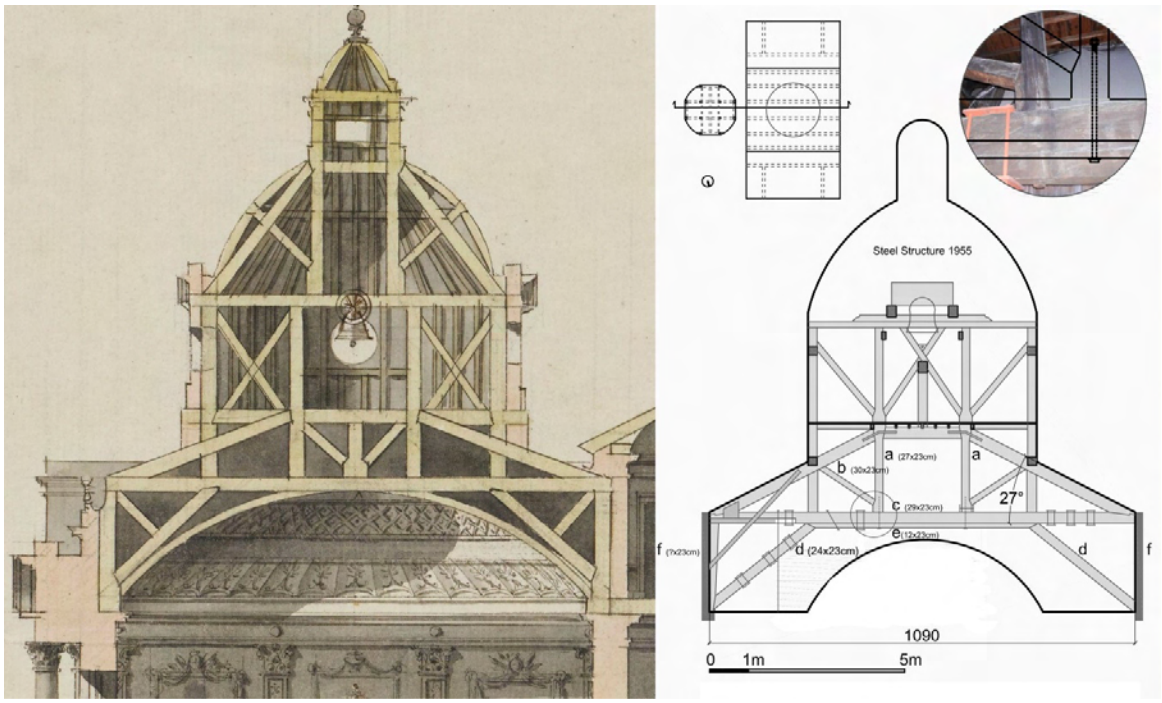


Figure 5: Transversal section of the roof structure at Glasgow Trades Hall, as designed by R. Adam on the left (SM Adam vol.48/25), and as built on the right (Anna Serafini); the graphic scale relates to both drawings.

The present structure (fig. 5) is composed of 8 parallel queen-post trusses; the 4 middle ones support a drum, dome and lantern above, and leave space for a dome below (originally wider). The span is not excessively wide (10.9m) but the structure is quite tall (10.5m below the lantern). The joints are correctly designed with joggles and iron straps so that the queen-posts (fig. 5, a) hang from the principals (fig. 5, b) and support the tie-beam (fig. 5, c). The bottom of the post is connected to the tie-beam with a system of cotters and folding wedges passing through the elements (fig. 5): a detail developed in England at the beginning of the nineteenth century, according to Yeomans (1992). It could thereafter be one of the very first uses of this device. The trusses sit on a lower 'arch' system, formed by two slanted braces (fig. 5, d) and a horizontal beam (fig. 5, e). The slanted braces spring from the base of timber posts (fig. 5, e) that are partly (on the left) or completely (on the right) embedded in the walls. On these posts sit the tie-beams.

This is one of the two weak points of the structure. The lateral posts and the wall-heads behind them are unable to counteract the horizontal thrust coming from the truss above. The lower 'arch' system partially opened in time and wooden wedges had to be inserted between the slanted braces and the horizontal beam. The wall-head was reconstructed and steel rods and plates were added with the same purpose. The other weak point is the insufficient longitudinal rigidity. Even though the sarking is still employed, the trusses do not rest on wall-plates - or if they do, they are embedded in the wall and therefore probably rotten - and they only have a few purlins connecting one to the other. This is probably why the dome structure had to be replaced in 1950s with a new steel structure (GCA Box 152 Drawing T6/7).

The structure drawn by Robert Adam in 1791 (fig. 5) shares the above mentioned critical points and also shows an improper design of the joints, which causes the posts to behave in compression, enhancing the tie-beam deflection instead of counteracting it. The built structure has some faults but it shows a better understanding of the trussed system and its construction details.

We do not have evidence of who designed this dome, the first in Glasgow, and little information could be found on John Brown, the wright/contractor at the Trades Hall, from whom no other building seems to remain. Brown was member of the Glasgow incorporation of wrights from 1790 until his death in 1816 (GCA T-TH 9/4/2 and T-TH 9/4/3). His appointment as contractor for such a major work as the Trades Hall only one year after becoming a member of the incorporation suggests he could have been brought from elsewhere by the Adams.

CONCLUSIONS

The existence of an independent Scottish school of carpentry has been denied by scholars such as Ostendorf (1908, in Hanke 2006) and Yeomans (1992). Overall conclusions are hindered by the lack of a more systematic research about the roof structures of the period. However, an outlined picture is emerging which shows characteristic patterns and practices in Scotland.

Hanke (2006) has identified distinctive Scottish features in sixteenth and early seventeenth centuries roof structures: the persistent use of the common rafter form, the sarking, the rafter foot, the absence of purlins and tie-beams. Thanks to the survey of the 29 groups of buildings, and the further research and study of Tweeddale House in Edinburgh and Glasgow Trades Hall, both by the Adam family, some initial conclusions can be tempted on the development of roofs in Scotland in eighteenth century, including when, how and by whom trussed roofs were introduced. Trussed roofs start slowly appearing from mid eighteenth century in Scotland. Whilst there is an unquestioned English influence in their arrangements, some details seem to indicate other sources. The 'joggle' detail, found in most Scottish structures, has been always considered a distinctively English feature but could originate from Serlio (1600). Moreover, examples as Brodie Castle Stables, show that notches were used as well as joggles (fig. 3). The characteristic Scottish sarking remains in use, even though butt-purlins are introduced. Cleats, extensively used in Italy too, reinforce the elements' section in critical points. King-posts sometimes have a "bulb" shape at the top, a detail whose origin remains uncertain so far (fig. 6).

The Adams knew the trussed roofs thanks to treatises and pattern-books in their library, and to their travels to London and Italy. Nevertheless, their drawings often show little understanding of the trussed system. William was the first to draw a trussed roof for a Scottish building in 1720, but none of the Adams buildings in the first half of the eighteenth century has trussed roofs. This brings to the hypothesis that, at least in the case of the Adam family, the design of roof structures was responsibility of the wright, rather than the architect. Although architects aspired to build trusses, it seems that at the beginning wrights were unable or unwilling to construct them. An external influence, from England and/or beyond, was necessary for the eventual establishment of trussed roofs in Scotland, as suggested by the heterogeneity of solutions and details.



Figure 6: The "bulb" shape at the top of the posts in (from left to right) Aunchinleck House (1755); Stirling Tolbooth (1785); Culzean Castle (end 18th century) (Anna Serafini)

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The Roof Structure of George Heriot's Hospital Chapel and the Roof Design of its period in Scotland

Anna Serafini and Cristina Gonzalez-Longo
Architectural Design and Conservation Research Unit (ADCRU), Architecture department, University of Strathclyde, Glasgow

ABSTRACT

The great developments in seventeenth- and eighteenth-century architecture in Scotland corresponded to a gradual development of roof construction techniques and structural arrangements: the challenge was to pass from large spans covered by open purlin structures, to large spans covered by shallower roofs carrying heavy plaster ceilings. Whilst the few remaining Scottish open purlin roofs have been widely investigated, little research has been carried out on the roof structures hidden behind timber and plaster ceilings, which, according to our surveys, are the vast majority in Scotland in that period. This paper investigates the timber roof structure of George Heriot Hospital's Chapel in Edinburgh, an original seventeenth-century common rafter roof with later alterations, and compares it with earlier and later examples in order to discuss the development of Scottish roof structures during the period, looking at the different constructional arrangements, the design process and the influence of the timber trade with North-East Europe.

1. INTRODUCTION

Timber roof structures in Scotland, as in other places, have been scarcely researched due to their location - hidden behind decorated timber or plaster ceilings. This has created a lack of awareness of their structural, technological and cultural importance. Despite recent contributions[1], it is still difficult to establish the extent and nature of historic timber roofs in Scotland, and to understand whether they are the result of local or international influences, or both. The authorship of these structures and the identity of wrights (Scottish for 'carpenter') also remains an unexplored aspect.

In Medieval times, large spans were covered in Scotland by open purlin structures such as the one in the fourteenth-century Darnaway Castle[2]. These structures have been extensively researched, because they are visible and quite spectacular. Nevertheless, the challenge for seventeenth- and eighteenth-century wrights was to pass from open purlin structures to shallower structures capable of supporting heavy plaster ceilings, which became fashionable at the time; little research has been dedicated to these hidden roof structures, although they are actually the vast majority of structures remaining in Scotland. Hanke has researched some of these, up to the mid seventeenth century, in Midlothian[3], primarily relying on previous literature and archival material but nevertheless conveying a valuable contribution. Newland[4], Thomson[5] and Crone[6] have instead researched about the timber sourcing and trade during seventeenth and eighteenth centuries, providing us with extremely helpful information on the timber species employed and their provenance.

This paper aims to build upon these previous valuable studies and start tracing the development of timber roof structures in Scotland. The work is part of a wider research on seventeenth- and eighteenth-century Scottish built heritage being carried out by the Architectural Design and Conservation Research Unit (ADCRU), within the Department of Architecture of the University of Strathclyde (Glasgow). Roof structures from the period have been identified as a priority area of research. A sample of 74 timber roof structures in 56 buildings has been surveyed, selected from the ADCRU database now including 1600 Scottish buildings from seventeenth and eighteen centuries. The development of roof structures in Scotland through these two centuries is discussed by looking at the roof structure of George Heriot's Hospital Chapel and comparing it with earlier and later examples, considering the different constructional arrangements, the design process and the influence of the timber trade with North-East Europe.

2. THE ROOF STRUCTURE OF GEORGE HERIOT'S HOSPITAL'S CHAPEL

The roof structure of the Chapel in George Heriot's Hospital (1628-84) illustrates well the impressive development that Scottish timber roof structures achieved through seventeenth and eighteenth centuries. At first it seems to be composed simply of closely spaced (about 30cm) rafter couples, with two collar beams connecting each couple transversally and slanted braces supporting the ceiling (Figure 1). The rafters are connected longitudinally by thick timber boards ('sarking' in Scottish), forming a continuous surface on which the lead is fixed with metal nails. Almost like an upside-down ship. The connection with the wall is not visible, unfortunately. The roof is quite steep (about 50°) but not excessively large (the span is 6.8m). The timbers are hand-axed softwoods connected with mortice and tenon joints secured by timber pegs. Big roughly sawn roman numerals mark all the frames, though not in sequence.

Walking through the roof space, it becomes clear that something different happens in the central part of the roof: here the structure is supported by two additional low-pitched queen-post trusses, inserted in-between the original timbers (Figure 2). The timbers composing these trusses have much bigger sections and have been machine-sawn. They are connected again with mortice and tenon joints, but secured with iron straps. The tie-beam is composed of two elements, joined with a scarf joint. Small neatly chiseled roman numerals mark each piece of timber. Two longitudinal purlins sit on top of the trusses and support the upper collar beams of the original roof. Two other purlins hang from the trusses - supported by iron rods and plates - and support the rafters of the original roof, which have been cut.

Although these trusses are clearly a later addition, their date remains uncertain, as well as the reason for their insertion. None of the roof timbers have been analysed with dendrochronology, the only technique that can identify precisely their date and provenance. Nevertheless, the analysis of available evidence and the comparison with earlier and later examples can help in drawing some possible conclusions.

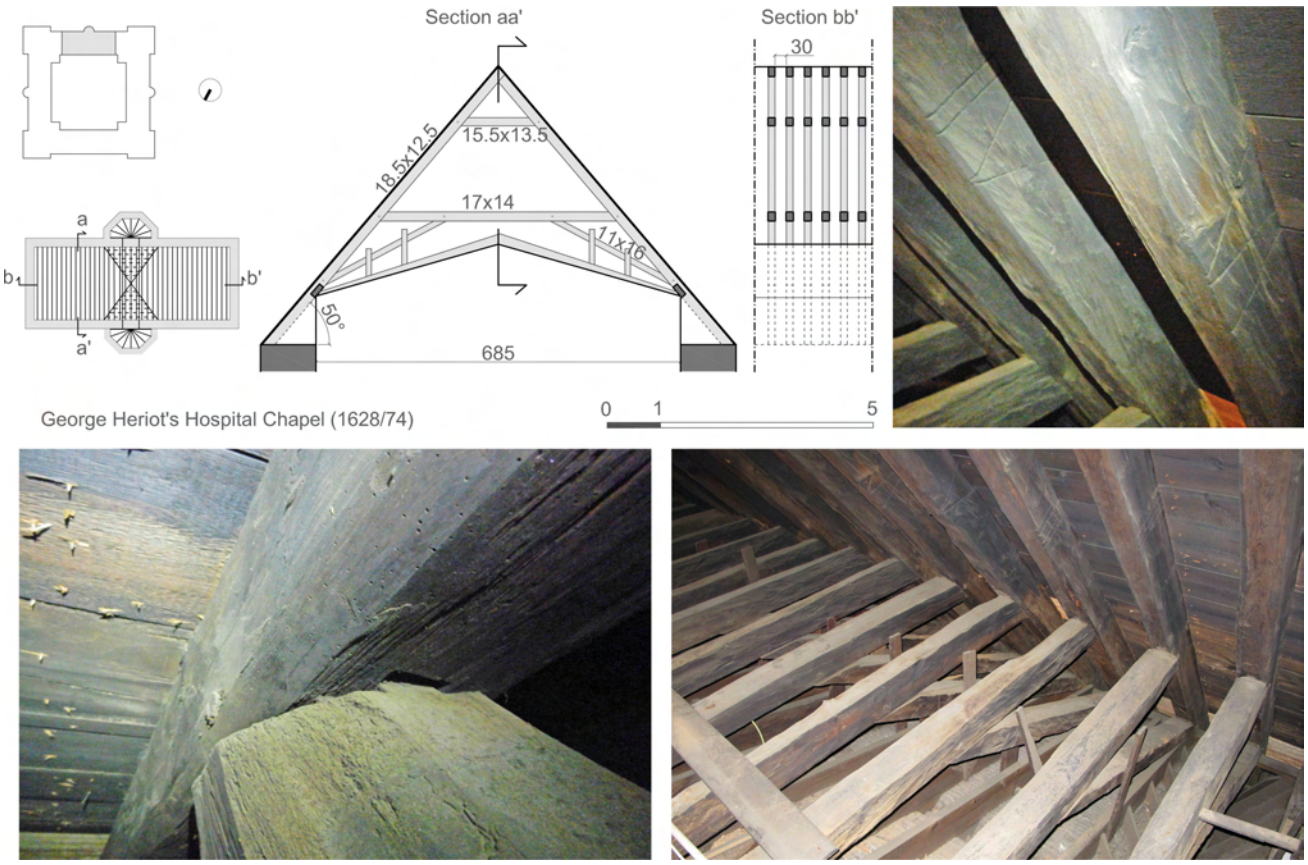


Figure 1. The common rafter roof covering the Chapel of George Heriot's Hospital (1628-74) (A.).

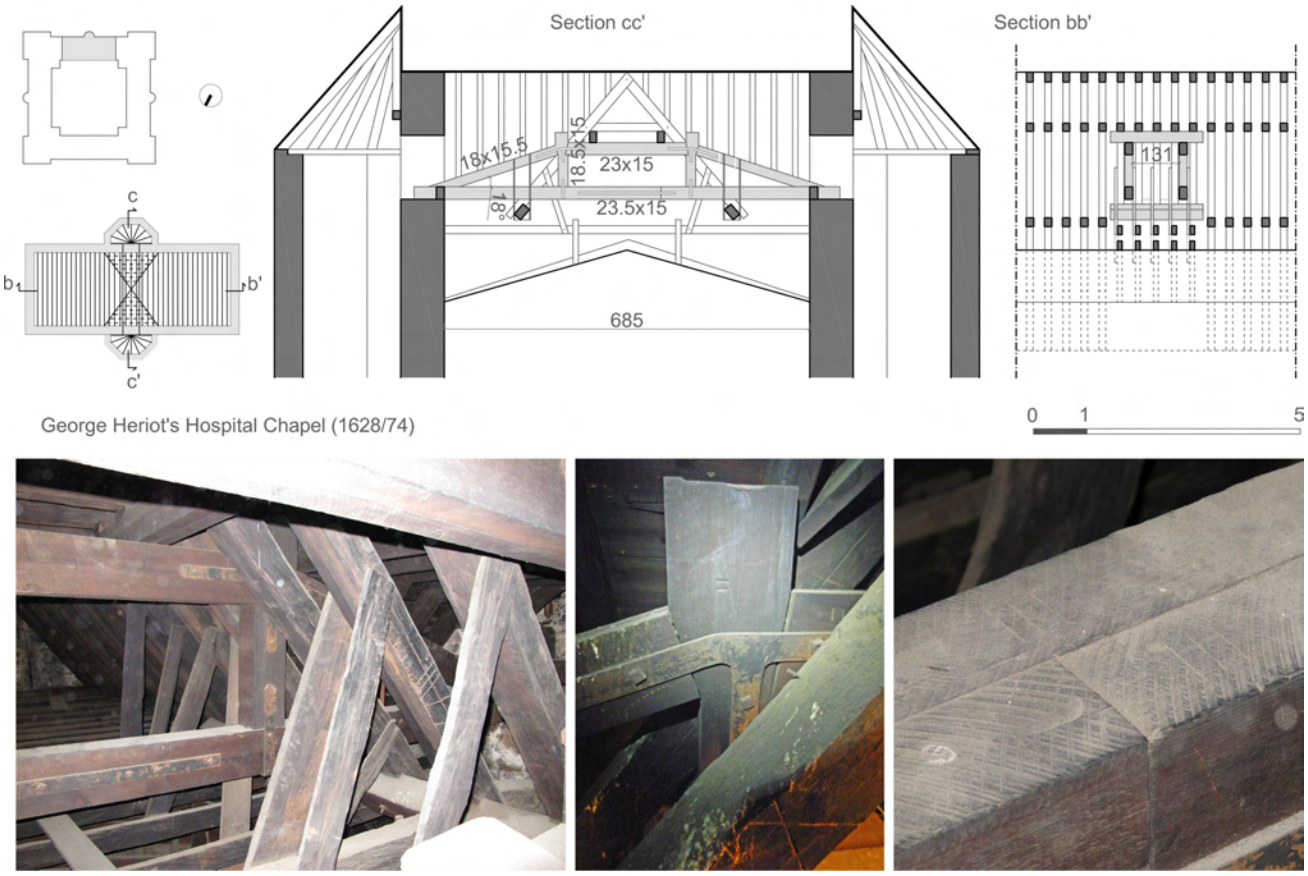


Figure 2. The trusses in the central part of the roof of George Heriot's Hospital Chapel (1628-74) (A.).

3 THE TIMBER SOURCING AND THE DESIGN PROCESS: NORWAY AND ROYAL MASTER WRIGHT JOHN SCOTT

Timber for works at George Heriot's Hospital was brought from Dalkeith, but large timber was imported from Norway[7]. This was a common practice from early sixteenth century up to early eighteenth century[8]. In fact, in 1503 the parliament declared that Scotland's woods had been 'utterly destroyed' and Acts were passed to protect local woods from over use. There were also accessibility problems and Scottish timber had a reputation for being of poorer quality compared to imported timbers, which where thus preferred[9]. Typical cuts of timber bought by the Scottish skippers from Norway included sawn boards for the sarking (deals), and beams between 4.4-11.4m in length for the rafters/collars, of either redwood (scots pine) or whitewood (common spruce)[10]. Scots pine is stronger than spruce and was therefore preferred for structural work. Such timber products were exactly what was needed to make a roof like the one covering George Heriot's Chapel: boards for the sarking and pine beams less than 7m in length (the longest timbers in George Heriot's are the rafters: 6.9m).

In December 1633 the mason John Ronald was paid for lintels for the wall-heads of the Chapel of George Heriot's Hospital[11]. In the same moment the Hospital's governors decided to cover the Chapel with lead[12] and in 1635 the work was contracted to John Bland, an English plumber from Newcastle[13]. In early 1637 the Hospital's Governors ran out of money and sent Bland back to Newcastle until they needed further lead work[14]. This makes us think that by 1633 the Chapel walls had reached the roof level and that by 1637 the Chapel had been roofed with lead already. However, the first wrights' account only appears in the Treasurer's accounts of 1638-9 with the wright John Scott as leader of a 6 men team[15]. It is highly unlikely that the Chapel roof structure was built without wrights on-site, but it seems that Scott was not much involved in the design of the Hospital roofs since in 1648 he suggests to dismantle the pavilion roof of the South-West tower for structural reasons, saying that 'it was never his opinione that the said southwest torret should be built in the way that it now standis'[16]. Other roofs were plat-formed as well in those years: the roofs of the North towers in 1642[17], the North range before 1647[18], and the South East tower in 1649[19]. These alterations, just a few years after the original construction, suggest that Scott hadn't been much consulted on the roofs' design in the first place.

In that same period Scott, Master Wright to Edinburgh from 27 January 1637 and Royal Master Wright from 9 June 1641, was also busy at the Edinburgh Parliament Hall (1631-40)[20] and Tron Church (1636-47), whose tailor-made structures (Figure 3) certainly needed more attention than the simple common rafter roof of George Heriot's Chapel. The two arch-braced open purlin roofs in the Parliament Hall and Tron Church show us that Scott knew very well how to design and construct complex roof structures. Nevertheless he chose to do something very simple in George Heriot's Chapel. One reason could be that the roof structure was never meant to be visible, as suggested by the slanted braces that were probably supporting the original ceiling (Figure 1). Economic constraints could be another reason, since the Hospital Governors often ran out of money and had to interrupt the construction works. A further hypothesis is that put forward by other scholars[21] according to whom the reliance on imported timber favoured timber structures characterized by few standardised items: deals (timber boards for the sarking) and straight, relatively short beams. If 'ready-to-build' timber roofs were available from Norway, that would have certainly been a cheaper solution than paying Scott to design the roof himself, and it would have allowed the Hospital's architect (whose attribution is still controversial) to simply order the timber himself, bringing in wrights only when the construction started.



Figure 3. Parliament Hall in Edinburgh (1631-40) on the left, and Tron Church in Edinburgh (1636-48) on the right (A.).

4 SCOTTISH COMMON RAFTER ROOFS

The common rafter roof in George Heriot's Chapel is not an isolated case. The roofs on which research has focused until 1990s are mainly the hammer-beam or open purlin roofs of fourteenth and fifteenth century that we find in the great halls of Darnaway Castle[22], Stirling Castle[23] and Edinburgh Castle[24], and the seventeenth-century Edinburgh Parliament Hall[25] and Tron church (1636-47) (Figure 5). All these roofs, however, seem to represent an exception rather than the rule, because Hay[26], Stell[27], Hanke[28] and Ruddock[29], all agree in suggesting that from the Middle Ages up to nineteenth century, the majority of Scottish roofs were characterized by a much simpler, closely spaced common rafter form, just like the one in George Heriot's Chapel. There are exceptions, like the purlin roof in Newark Castle (1597-99)[30], or the more elaborate common rafter roofs in Glasgow Cathedral (thirteenth century)[31] and Moray House (seventeenth century)[32] with their scissor braces, or even the low pitched roof structure with posts and purlins covering Stirling Holy Rude Church (end fifteenth century). These exceptions confirm that Scottish wrights had the skills and expertise to design and construct more complex structures, when needed. However, when the spans were reduced and the structures weren't visible they opted for very simple structures: our surveys confirm the impression that most Scottish roofs of seventeenth and eighteenth-century are of simple common rafter form. This is remarkable considering the wider European context, where common rafter roofs were used earlier, up to thirteenth century[33].

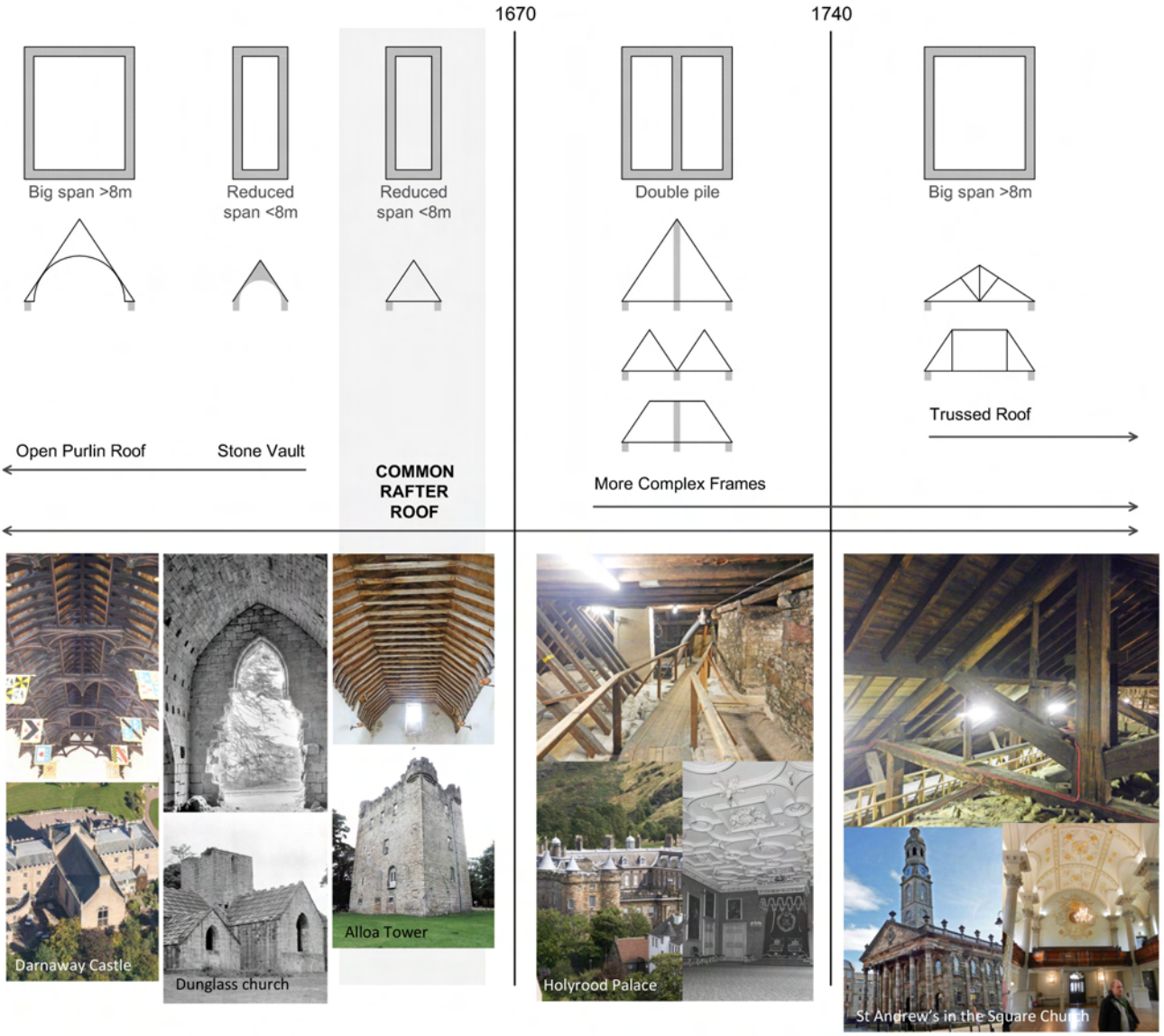


Figure 4. The development of Scottish timber roof structures. From left to right: Darnaway Castle (RCAHMS), Dunglass Church (RCAHMS), Alloa Tower (A.), Holyrood Palace (ceiling RCAHMS, exterior and roof space A.), St Andrew's in the Square Church (A.).

The reason for this extensive use of simple roof structures throughout the centuries lies in the development of Scottish architecture of the time and in the availability of material. Before 1500 Scottish architecture was characterized by single pile buildings, with square or rectangular plans mainly. From the few remaining roof structures of the period, one can deduce that tower houses, castles, churches, chapels, tollbooths were all covered with simple roofs sandwiched between two masonry gables. It was not until late sixteenth century that intersected roofs started being used, as testified by buildings such as Northfield House (c. 1590) and Newark Castle (1597-99)[34]. However, George Heriot's Chapel roof with its two end gables shows that even in the first half of the seventeenth century intersected roofs were still not common practice. The internal structure depended on the span to achieve: open purlin roofs, or hammer-beam roofs in case of big spans (more than 8m), and stone vaults or simple timber common rafter roofs in case of reduced spans (Figure 4). The oldest surviving Scottish common rafter roof we know of is in the thirteenth-century Glasgow Cathedral[35], which differs from the common form with its scissor braces. The roof in Alloa Tower, first mentioned in 1497 but maybe older[36], could be another good candidate. These first examples are all open roofs, visible from underneath. However, painted timber and then plaster ceilings became fashionable even before 1600, relieving timber roof structures from any aesthetical requirements.

We have surveyed 30 common rafter roof structures from the period between the end of sixteenth century and 1700 across Scotland. As the roof in George Heriot's Chapel, they are generally simple gabled roofs composed of rafter couples, spaced 30-60cm, each with one or two collar beams (Figure 5). The rafters are connected longitudinally by sarking boards and they are often simply sitting on the wall-head (as in Pinkie House, figure 5), or on a sole piece tenoned into an ashlar post extended downward on the masonry (as in Cockenzie House, figure 5) - this arrangement is called 'Scottish rafter foot'. The space in-between the rafter feet is often infilled with rubble masonry to increment the lateral rigidity. The timber elements are generally made of a whole log roughly squared with an axe to 8-15cm scantlings, often preserving some bark on the corners[37]. The joints are normally mortise and tenon (as in Pinkie House, figure 5), or later simple lap (as in Cockenzie House, figure 5), secured with timber pegs (as in Pinkie House, figure 5), or later metal nails (as in Cockenzie House, figure 5). The spans are usually less than 7m, and the pitches are quite steep (50°-60°). The frames are normally numbered with roughly sawn roman numerals that cover the entire section of the elements. As already suggested by Hay[38], it seems that these carpentry marks were used mainly to understand which rafters and collars composed a single frame - once the frames were complete, it didn't matter if frame I was placed before or after frame II, which is why the frames are often not in sequence (as in Pinkie House, Cockenzie House and George Heriot's Chapel).

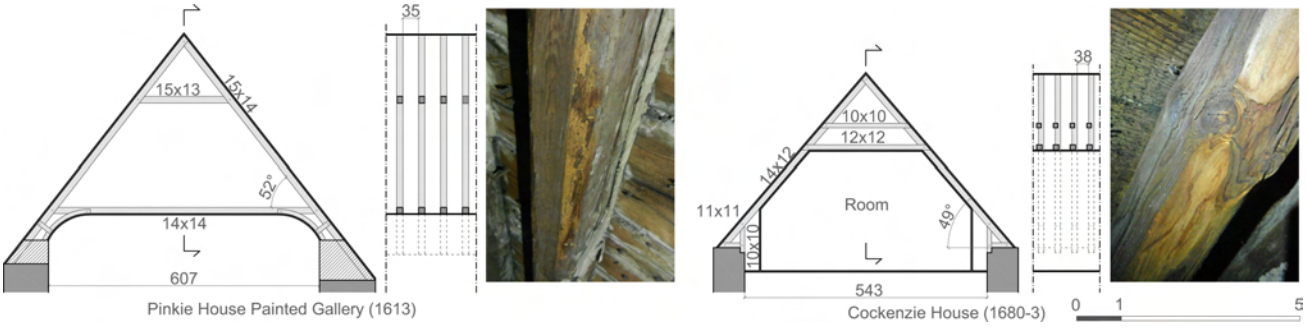


Figure 5. The common rafter roofs at Pinkie House's painted gallery (1613) on the left, and Cockenzie House (1680-3) on the right (A.).

The common rafter roof in George Heriot's Chapel is in line with contemporary Scottish common rafter roofs as regards to its general arrangement, span, pitch, joints and carpentry marks. However, the timbers are a bit bigger and more rectangular (the rafters are 18.5x12.5cm - height x base) than other contemporary roofs we've surveyed, and, although hand-axed, they've been more carefully squared and finished, leaving no bark on the corners (Figure 1). Furthermore, the slanted braces that connect the lower collar to the rafters, and that probably supported the original ceiling, is a detail that hasn't been found in many other Scottish roofs. Earlier roofs generally employed arched braces supporting painted timber ceilings (as in Pinkie House, Figure 5), and later roofs generally had the plaster ceiling directly attached to the rafters and the lower collar (as in Cockenzie House, Figure 5). The use of such braces was however not uncommon in other Northern and Central European common rafter roofs[39]. Scottish common rafter roofs are in fact similar to European ones in many respects, but, as already stated above, the extensive use in Scotland of this simple form of roof throughout the centuries up to today is somehow unusual since in England and Northwest Europe king/queen struts and side purlins were introduced already in thirteenth century[40]. Moreover, Scottish common rafter

roofs do differ from the English and European ones in some aspects, as confirmed by our surveys: they have no tie-beam up to 1700[41]; they never have additional longitudinal bracing (such as purlins) other than the sarking boards up to the first half of the seventeenth century[42]; they have no wall-plates up to late seventeenth century[43] but sometimes provide additional rigidity through the Scottish rafter foot. The Scottish rafter foot has always been thought to be a distinctive Scottish character but was actually already known by the late twelfth and early thirteenth century Dutch and French carpenters[44]. Nevertheless, just like the sarking, which is not unknown in Europe[45], it seems to have never been so extensively used as in Scotland.

5. LATE SEVENTEENTH CENTURY INNOVATIONS

The roof of George Heriot's Chapel, with its bigger timbers more carefully finished, anticipates the characteristics and innovations of late seventeenth-century Scottish roofs. From 1670s onwards common rafter roofs had in fact to adapt to the new geometries and aesthetical requirements of classical architecture, introduced in Scotland by the architects Sir William Bruce and Mr James Smith. It was no longer fashionable to see the timber roof structure, which was now hidden behind heavy plaster ceilings. At the same time, it was also no longer fashionable to have gabled high pitched roofs: architects now wanted shallow roofs, or platform roofs, more in keeping with the classical facades that they designed. M roofs, hipped and platform roofs were introduced (Figure 4), but internal timber structures took some time to evolve and become efficient enough to be able to carry heavy plaster ceilings over big spans.

An early attempt can be seen in Holyrood Palace (1671-9) (Figure 6). The structure is still a common rafter roof, with no longitudinal connection other than the sarking boards, but it spans above a double pile plan and uses the intermediate spine wall as additional support. Double piles had already been introduced since sixteenth century: Drochil Castle (1578) has one of the very first known double pile plans - the roof hasn't survived unfortunately, but from what remains we can hypothesize that it was gabled, probably with a common rafter structure spanning over the double pile, supported by one or two of the intermediate spine walls. This type of structure was used up to mid eighteenth century, as testified by Tweeddale House in Edinburgh (1754-56)[46]. Sir W. Bruce did the same in Holyrood Palace, but introduced the platform roof and other innovative features, such as tension absorbing joints (dovetail joints, highlighted in black in Figure 6). It must be underlined that up to then Scottish wrights understood timber elements as behaving in compression only: in structural terms the fifteenth, sixteenth and seventeenth-century open purlin roofs and common rafter roofs resemble barrel vaults, because all the elements that compose them are behaving in compression, just like voussoirs in stone arches[47]. The use of tension absorbing joints allowing timber elements (collars in the case of Holyrood Palace) to work as ties, in tension, is therefore an important innovation.

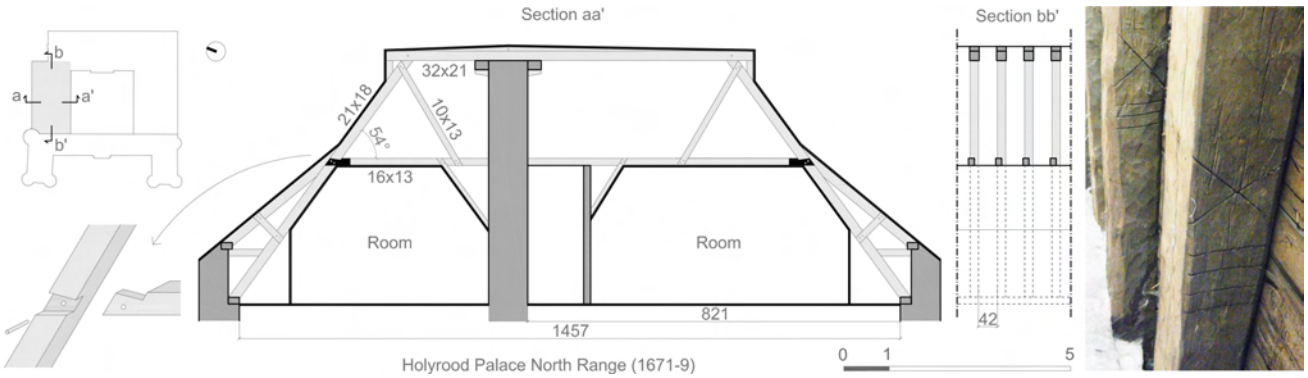


Figure 6. The roof structure of Holyrood Palace (1671-9) with the tension-absorbing joints and members highlighted in black (A.).

Holyrood's roof achieves a shallower external geometry, but fails in attaining an undisturbed big span inside, since it still relies on the intermediate spine wall as support. Roof structures had to evolve a bit further to be able to get rid of this wall. It was eventually necessary to import from elsewhere a completely different structural type: the trussed roof.

6. THE INTRODUCTION OF TRUSSED ROOFS

In the first half of the eighteenth century butt-purlins were introduced as additional longitudinal bracing and rafters started being distinguished into primary and secondary ones, which significantly reduced the amount of timber needed. The roof covering the central hall of Yester House (1729-48) is the first known example of primary rafters ('a' in Figure 7) spaced about 2.5m apart and connected by purlins ('b' in Figure 7), which in turn support the common rafters ('c' in Figure 7). The timbers' scantlings and dressing changed as well: they became bigger and more and more rectangular. Holyrood Palace's rafters are already bigger compared to the previous common rafter roofs (21x18cm - height x base), but Yester House's rafters are even bigger and more rectangular (27x17cm – height x base). Moreover, some of their faces are hewn rather than axed: the use of pit and frame saws was not unknown in seventeenth-century Scotland, but it became common only in the following century, when Scotland started importing from the Eastern Baltic area big timber baulks, often large enough to be processed further by wrights on-site into narrower joists or rafters[48].

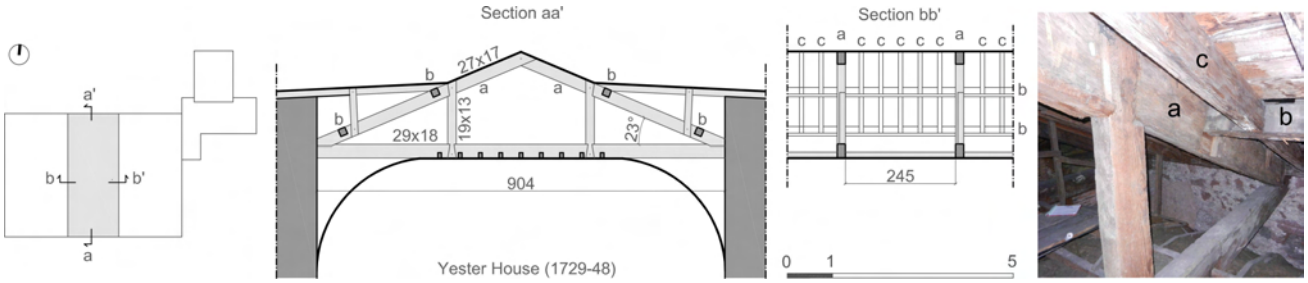


Figure 7. The roof structure of Yester House (1729-48) (A.).

Yester House's roof has a structural behaviour closer to that of a trussed roof, rather than to that of a common rafter roof. It can thus be seen as an antecedent of trusses, just as Tweeddale House[49]. In the second half of the eighteenth century the trussed roof was in fact introduced in Scotland (Figure 4)[50]: our surveys suggest that from 1740s/50s king-post trusses started being used to cover reduced spans (as in Fort George Museum and Staff blocks, 1762-6), and princess-post/queen-post trusses to cover bigger spans (as in St Andrew's in the Square Church, 1739-56).

We have surveyed 13 trussed roofs across Scotland, including the one above the Trades Hall in Glasgow (1791-4) (Figure 8), which lends itself to an interesting comparison with the truss in George Heriot's Chapel. The Scottish trusses surveyed so far have quite different external geometries and internal arrangements, some developing veritable 3D structures (as in St Andrew's and St George's Church, 1782). The spans reach their maximum in Oakshaw Trinity church (1754-6) with about 20m, and pitches vary between 44° and 27°. The sarking is always retained, even though butt-purlins are always employed as well. Posts normally have joggles, which could be an English influence[51], but traces of other influences can be identified too[52]. Joints are all mortice and tenon with timber wedges and sometimes timber dowels; scarf joints are rare and metal straps are seldom used - in some cases they are a later addition, as testified by the Trades Hall truss where the metal straps have been added 50 years after the construction of the building[53].

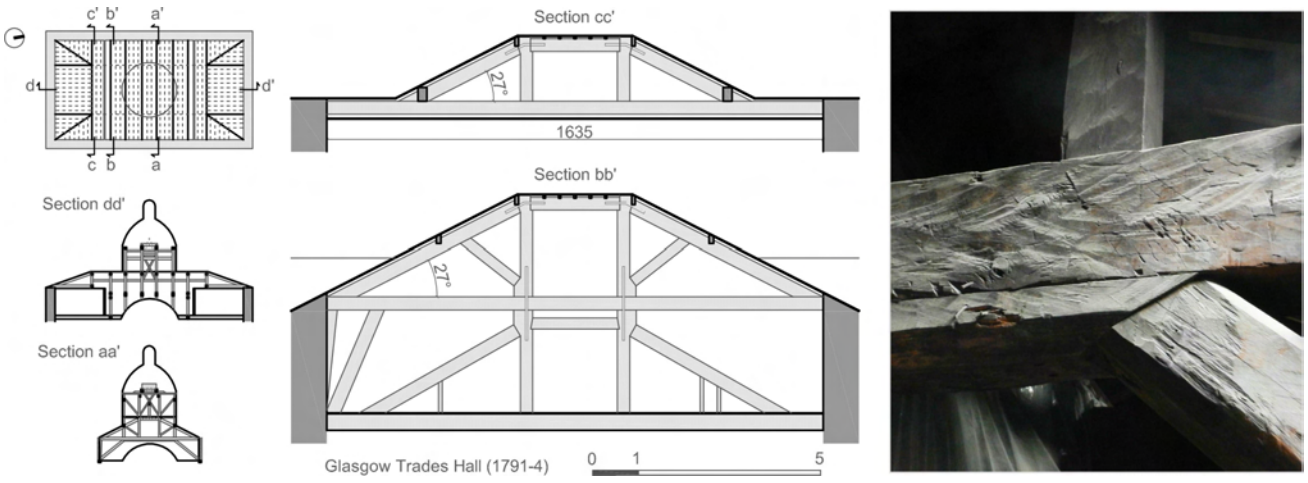


Figure 8. The roof structure of the Trades Hall in Glasgow (1791-4) (A.).

The two queen post trusses in George Heriot's Chapel are not that different from the ones in the Trades Hall (Figure 2 and section cc' in Figure 8). In order to understand when and why they have been added to the original structure, it's necessary to have a look at the Chapel's construction history from were we left it in 1637, once the roof had been covered in lead. The interiors remained incomplete until Thomas Sandilands, one of Scott's apprentices, was contracted in 1683 to finish the work[54]. Sandiland's account unfortunately does not provide us with enough details to understand how the ceiling of the Chapel might have looked like after his works. In this period plaster ceilings were gradually substituting timber ones, but the latter were still in use. The Chapel's roof structure with its slanted braces would have easily accommodated a painted timber ceiling like the 1626 one in Provost Skene's House (Figure 9a). Nothing as grand as this is mentioned anywhere though, therefore the most probable hypothesis is that a simple timber or plaster ceiling was installed until further funds were found.

In 1787 the chapel was refitted with a new ceiling[55]. Robert Adam might have been involved since he had been consulted previously for other matters[56]. An undated drawing held in RCHAMS shows a decorated ceiling that seems to match with evidence found in the roof space (Figure 9b and c). The central part of the roof structure was altered at this time to allow for this new ceiling to be installed. The rafters were cut ('a' in Figure 9-10), leaving exposed the mortice and tenon joints were the lower collars used to be (Figure 10 right). A purlin was inserted on each side to support the cut rafters ('b' in Figure 9-10). The purlins were kept in place by a collar ('c' in Figure 9-10) spanning transversally in-between them, and two struts ('d' in Figure 9-10) pushing on the lateral walls. Ceiling joists ('e' in Figure 9-10) were then placed beneath and connected to the rafters with timber struts ('f' in Figure 9-10).

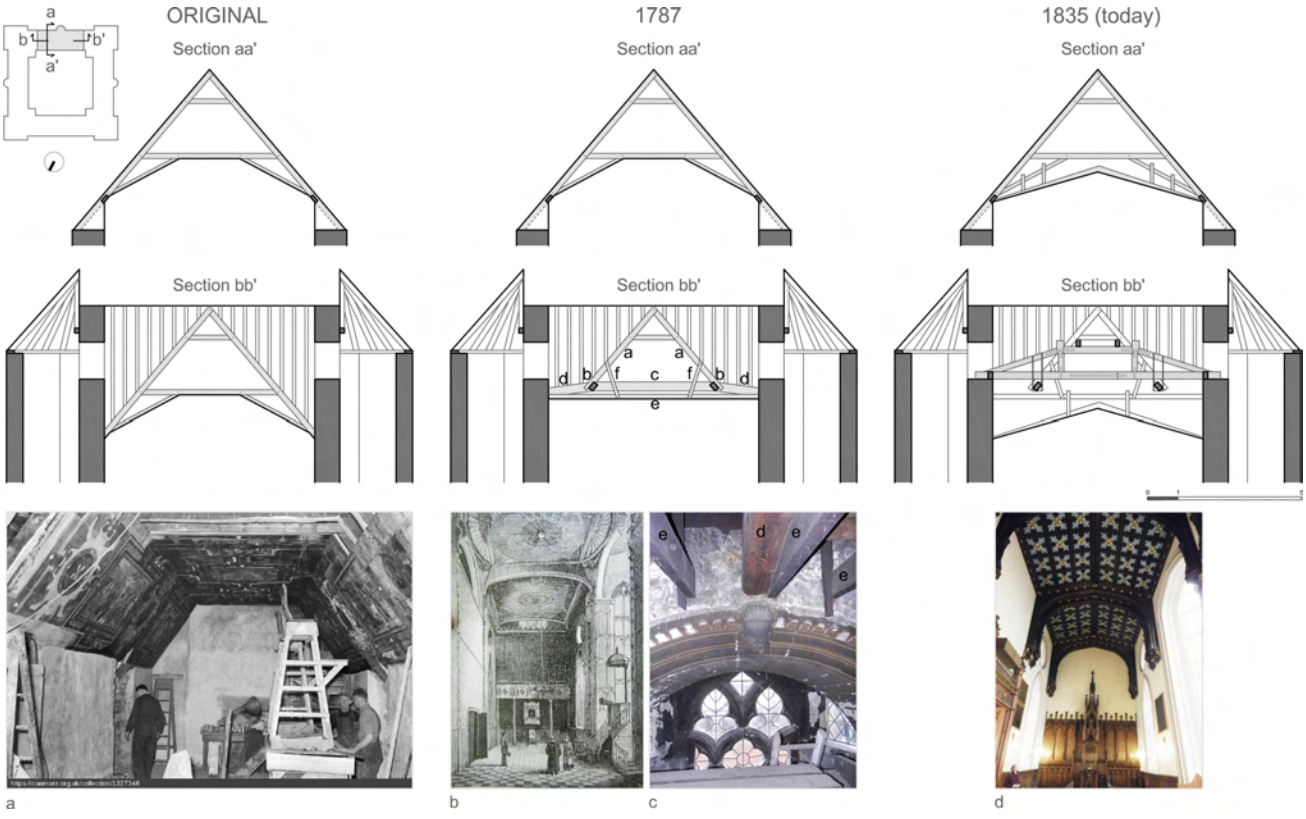


Figure 9. Alterations in time to the roof structure and ceiling of George Heriot's Chapel. From left to right: a) the original ceiling might have been a timber ceiling similar to the 1626 one in Provost Skene's House (RACHMS); b) an undated drawing (RCAHMS) shows what the 18th century ceiling might have looked like after the renewal in 1787; c) remains of the 18th plaster decorations are visible in the roof space (A.); d) a view of the ceiling today, as renewed in 1835 (A.).

In December 1833 the governors ordered to replace the whole plaster-work for structural reasons[57]: James Gillespie Graham prepared a design and the works were carried out in 1835 with the collaboration of the cabinetmaker William Trotter[58]. Gillespie's work is what we see today (Figure 9d). The two trusses were added at this time to reinforce the central part of the roof structure, which had been weakened by the late eighteenth-century interventions. They are clearly of nineteenth century dating because their pitch (18°) is much lower than that of late eighteenth-century Scottish trusses: the truss above the Trades Hall in Glasgow (Figure 8) is the shallowest we've surveyed so far

with its 27° pitch. Moreover, the timber elements composing the trusses in George Heriot's Chapel have been machine sawn. We know that mechanical sawmills started being employed in Scotland only from early nineteenth century and became common after 1820[59].



Figure 10. Alterations in time to the roof structure and ceiling of George Heriot's Chapel (A.).

7. CONCLUSIONS

Seventeenth- and eighteenth-century architecture in Scotland has not been sufficiently researched from the point of view of its structural and constructional configuration. Timber roof structures in particular have been very rarely researched due to their location - hidden behind timber or plaster ceilings – and to the lack of awareness of their structural, technological and cultural importance.

Building upon the few previous studies on Scottish roof structures and timber trade and thanks to the survey of 74 timber roof structures in 56 buildings across Scotland we can start tracing their development through seventeenth and eighteenth centuries. Research so far has focused on few medieval open purlin roofs, but our surveys confirm the impression that most Scottish roofs of seventeenth and eighteenth centuries are of simple common rafter form hidden behind timber or plaster ceilings, like the one in George Heriot Hospital Chapel (1628-84). The Chapel roof illustrates well the impressive development that Scottish timber roof structures achieved through seventeenth and eighteenth centuries, as it still retains the original seventeenth century roof structure with later alterations and additions.

The Chapel's original roof structure, built in 1630s, is a simple common rater roof. The timber used was imported from Norway as was common in that period, since local Scottish timber was difficult to transport and of low quality. John Scott, Royal Master Wright, was in charge of the timber works at George Heriot's. In the same period he was also working at the Edinburgh Parliament Hall and at the Tron Church, whose roof structures suggest that he had the skills and expertise to design and build complex structures. Nevertheless he chose to do something very simple in George Heriot's Chapel, probably because of economic constraints and because the structure wasn't meant to be visible. The influence of the timber trade with Norway was also another important aspect, as it probably simplified the roofs' design and construction processes, allowing for wrights to be little involved in the design.

The Chapel roof is in line with other contemporary Scottish common rafter roofs, but it has some characteristics that anticipate the innovations of end seventeenth century, when common rafter roofs had to evolve and adapt to the new geometries and aesthetical requirements of classical architecture. From 1670 wrights started employing tension absorbing joints and members, as in Holyrood Palace. Timbers became bigger and with more rectangular sections, and they were sawn rather than axed only. Primary rafters connected by purlins were introduced, reducing the amount of timber needed, as in Yester House. However, in order to avoid the use of an intermediate spine wall and attain a big undisturbed span it was eventually necessary to import from elsewhere a completely different structural type: the trussed roof. Trusses started being employed in Scotland from 1740s in the vast majority of public buildings and big country houses, and they were soon used even for reduced spans, as In George Heriot's Chapel: the central part of the

Chapel's roof structure has in fact been altered repeatedly to accommodate different ceilings, and at the beginning of the nineteenth century two trusses were introduced as reinforcements. Their dating to nineteenth century is suggested both by the pitch, a lot lower than that of late seventeenth-century Scottish trusses such as the one above the Trades Hall in Glasgow, and by the dressing of the timber, which is machine-sawn.

8. NOTES

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[4] Newland 2012, op. cit.; Newland, K. (2010), 'The Acquisition and Use of Norwegian Timber in Seventeenth Century Scotland, with reference to the principal building works of James Baine, his Majesty's Master Wright', University of Dundee, unpublished PhD thesis; Newland, K. (2007), 'Norwegian Timber and the Scottish Great House', *Arch. Herit*., 18:1, 35-53.

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[7] Lockhart, B. R. W. (2003), *Jinglin Geordie's Legacy: A History of George Heriot's Hospital and School*, Edinburgh., p. 29: following the orders of the Town Council, the Hospital Treasurer commissioned in July 1627 two Leith ship-owners to transport a shipload of large timber from 'Norroway', and other timber kept being imported in the following years. Unfortunately the primary source on which Lockhart's statement is based, the Minutes of Heriot's Hospital, are not available for consultation anymore, and it is therefore impossible to know more about the type of timber products that were imported. The following timbers, which have probably been used for the Hospital's roof structures, are mentioned in the treasurer's accounts between 1636 and 1639: 207 great trees, 19 draught long trees, 125 double trees, 1200 deals (National Records of Scotland - NRS, Records of George Heriot's Trust, Edinburgh, Accounts and other Financial Papers of George Heriot's Hospital and Trust, Treasurer's accounts 1633-1642, GD421/5/2).

[8] Newland 2010, op. cit.

[9] As argued by Thompson 1991, op. cit., softwoods need short hot summers and long cold winters to form sound timber of slow growth. Scottish climate is instead cool, humid and temperate, which is why home grown Scottish softwoods are not very strong and durable, even today. Scandinavian/Russian softwoods are instead slow grown and therefore of better quality. On top of scarcity and low quality, high extraction and transportation costs restricted the use of Scottish timber: not many rivers were adequate for timber floating and there were often disputes with the fishermen. Moreover, Scotland was characterised by a technological backwardness in sawmilling, which improved only from the end of the eighteenth century.

[10] Thompson 1991, op. cit.

[11] 'two grait stones to the chappell zet heid' citation in Lockhart 2003, p. 53.

[12] 'theak the Chapel with lead' ibid.

[13] Lockhart 2003, op. cit., p. 53.

[14] 'till he sould be written for be the counsell qhen they would have adoe to cast mair lead' citation in Lockhart 2003, op. cit., p. 54.

[15] NRS GD421/5/2, op. cit.: Scott was paid 6£ weekly, just like William Aytoun, leader of the masons.

[16] Citation in Lockhart 2003, op. cit., p. 57-58.

[17] Lockhart 2003, op. cit. p. 56.

[18] As proved by the view drawn by Revd. James Gordon of Rothiemay in 1647 (in Lockhart 2003, op. cit., p. 57).

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[21] Newland 2010, Hanke 2006, op. cit.

[22] Stell and Baillie 1993, op. cit.

[23] Crone and Fawcett 1998, Hanke 2007, op. cit.

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[28] Hanke 2006, op. cit.

[29] Ruddock, T. (1995) ' Repair of two important early Scottish roof structures', *Proc. Inst. Civil Eng*., 110, 296-307.

[30] Hanke 2012, op. cit.

[31] Oldriev, W. T. (1916), ' The ancient Roof of Glasgow Cathedral', *Proc. Soc. Antiq. Scotl*., 50, 155-172.

[32] Hanke 2004, op. cit.

[33] For the development of timber roof structures in England and Europe see: Blaha, J. (2006), 'The evolution of roof timber frame in the Southern part of Bohemian-Moravian Uplands from 14th century to the 19th century, in M. Drdacky (ed.), *European Research on Cultural Heritage: State of the Art studies*, Prague; Hewett, C. A. (1980), English Historic Carpentry, Chirchester; Hoffsummer, P. (2011), *Les Charpentes du XI au XIX siecle – Grand ouest de la France*, Turnhou; Janse, H. (1989), *Houten Kappen in Nederland 1000-1940*, Amsterdam; Ostendorf, F. (1908), *Die Geschichte des Dachwerks*, Leipzig; Pompejano, F., S. Podesta', C. Chesi, (2015), 'Preliminary studies on the structural behaviour of traditional timber roofs in Gjirokastra, Albania', In J. Jasienko & T. Nowak (eds.), *Structural Health Assessment of Timber Structures*, Wroclaw, Poland, 9-11 September 2015; Szabo, B., I. Kirisan (2006), 'Continental historic roof structures in central Europe', in M. Drdacky (ed.), *European Research on Cultural Heritage: State of the Art studies*, Prague; Tampone, G. (2006) ,'Coverings of the Italian architectural heritage', in M. Drdacky (ed.), *European Research on Cultural Heritage: State of the Art studies*, Prague; Tsakanika, E. (2007), 'Byzantine and Post-Byzantine Historical Timber roofs in Greece. Typical failures, misunderstanding of their structural behaviour, restoration proposals', ICOMOS (Wood Committee), 16th International Conference and Symposium "From material to structure", Florence, Venice and Vicenza, 11-16 November 2007.

[34] Hanke 2012, op. cit.

[35] Oldriev 1916, op. cit.

[36] Ruddock 1995, op. cit.

[37] As noted also in Crone and Mills 2008, op. cit., p. 28.

[38] Hay 1976, op. cit., pp. 31-32.

[39] See for example Ostendorf 1908, op. cit., and Janse 1989, op. cit.

[40] Blaha 2006, Hoffsummer 2011, Janse 1989, Ostendorf 1908, Szabo and Kirisan, 2006, op. cit., Yeomans, D. T. (1992), *The trussed roof: its history and development*, London.

[41] The heavy stone walls of medieval and renaissance Scottish buildings easily counteracted the horizontal thrust resulting from these roofs without tie-beams. The first known Scottish roof with a tie-beam is in Yester House and dates probably to the construction works of 1699-1715.

[42] The first known Scottish roof with purlins is in Yester House and dates probably to the construction works of 1729/48.

[43] The first known Scottish roofs with wall-plates are in Gardyne's Land in Dundee (possibly end 17th century) and Methven Castle (1678/81).

[44] Courtenay, L. T. (1985), ' Where Roof Meets Wall: Structural Innovations and Hammer-Beam Antecedents, 1150–1250', *Annals of the New York Academy of Sciences*, 441, 89-124.

[45] Sarking boards are in use in Greece and Albania: Pompejano et al 2015, Tsakanika 2007, op. cit.

[46] Serafini, A., C. Gonzalez Longo (2015), 'The design and construction techniques of eighteenth century timber roofs in Scotland: Glasgow Trades Hall and Tweeddale House in Edinburgh', in Donald Friedman et al (eds.), *Proc. 5th Intern. Constr. History Congress*, 3-7 June 2015, Chicago.

[47] This has been suggested by Hanke 2006, op. cit., p. 30.

[48] Thompson 1991, op.cit.

[49] Serafini and Gonzalez Longo 2015, op. cit.

[50] It seems that trussed roofs were in use in Italy since roman times (Valeriani, S. (2006), 'The roofs of Wren and Jones: a seventeenth-century migration of technical knowledge from Italy to England', Working papers on the nature of evidence: how well do 'facts' travel?', Department of Economic History, London School of Economics and Political Science), and were employed in England since mid seventeenth century, when classical architecture was introduced by Inigo Jones (Yeomans 1992, op. cit.). As stated above, in Scotland trusses started being used about 100 years later, but it's not clear who was responsible for their introduction into the country. An analysis of drawings and buildings of the Adams suggests that although architects aspired to build trusses, wrights were initially unable or unwilling to construct them (Serafini and Gonzalez Longo 2015, op. cit.).

[51] Yeomans 1992, op. cit.

[52] Serafini and Gonzalez Longo 2015, op. cit.

[53] An uncatalogued drawing held in the basement of the Trades Hall shows a survey of the timber roof structure carried out by the architect Charles Wilson in October 1856 and the interventions that he carried out to repair it, including the addition of iron bars.

[54] National Records of Scotland (NRS). Records of George Heriot's Trust, Edinburgh, Administrative records of Heriot's Hospital and school statutes, foundationers, staff building, housekeeping, Detailed account and discharge by Thomas Sandilands, wright, to the treasurer of George Heriot's Hospital for £683 Scots for timber and wright work performed on the chapel and lodge (or summer house) in the Easter garden, 16 Jan 1685, GD421/10/68. Prior to Sandiland's intervention the Hospital's governors had fitted the Chapel with materials from the dismantled kirk of Cromwell's citadel in Leith: the timber seats, steeple, stone and glass work were taken for the chapel's repair in April 1673 (Lockhart 2003, op. cit., p.67). The walls were nevertheless left bare and the roof left with little ornament (Lockhart 2003, op. cit., note 98, p.47).

[55] Lockhart 2003, op. cit., note 98, p.351.

[56] Lockhart 2003, op. cit., p.101.

[57] It was reported that the 'the plaster which is overloaded with ornament is unsafe and consequently that both lath and plaster ought to be immediately taken down', even because the 'ceiling has been slightly and injudiciously executed, and the decorations also executed in a style unworthy of, and incompatible with, the architectural character of the Edifice', citations in Lockhart 2003, op. cit., pp. 121-2.

[58] Lockhart 2003, op. cit., pp.121-3.

[59] Crone and Mills 2008, op. cit., p. 32.

Seventeenth and eighteenth century timber roof structures in Scotland: design, pathologies and conservation

A. Serafini & C. Gonzalez Longo
Department of Architecture, University of Strathclyde, Glasgow, UK

ABSTRACT: Seventeenth and eighteenth century architecture in Scotland has not been sufficiently researched, despite its importance in both quality and quantity. Most scholars tend to investigate the external architectural composition of these buildings rather than their overall constructional configuration. In particular, timber roof structures are very rarely considered even though the integrity of the overall building depends largely on them. This lack of knowledge hinders good conservation practice. This paper aims to increase awareness about the extent, nature, value and condition of historic timber roofs in Scotland in order to understand what their conservation needs are. Preliminary results obtained from the creation of a relational database of 1550 buildings, related mapping, survey of 56 buildings of the period across Scotland and historical/archival research, are discussed. This has allowed for an initial understanding of the different structural types of Scottish timber roofs of the period as well as their pathologies.

1 INTRODUCTION

This work is part of a wider research on seventeenth and eighteenth century architecture in Scotland being carried out by the Architectural Design and Conservation Research Unit (ADCRU), in the Architecture Department of the University of Strathclyde. The aim is to recognize the value of this important built heritage, which has not been sufficiently investigated so far, in an integrated and comprehensive way, beyond the usual external descriptions.
A relational database of 1550 buildings from the period has been created. It includes information on structures, designers, craftsmen, clients and the different interventions. During this research it became apparent that timber roof structures are one of the most neglected topics of research and as consequence their value is not appreciated and many of the original roofs are replaced. Research on the use of timber in Scottish architecture has been widely published but there has been little focus on its structural use, particularly in roofs. Despite the recent work of scholars such as Hanke (2006), Newland (2010), and Crone (Crone and Mills 2012), we are still unable to say what is the extent and nature of original Scottish timber roofs, even because the research done is based more on archival documents and literature than on surveys. Moreover, no research has been carried out on the present condition of these structures. This lack of knowledge hinders good conservation practice: the value of Scottish timber roof structures is not recognized and their structural behaviour is often misunderstood, resulting in their replacement or over-consolidation.
The assessment of historic timber structures can be challenging, being timber an organic material with variable properties. Professionals are often uncertain about the safety of a timber roof structure, due to the lack of training and knowledge on timber structural behaviour, the limited amount of regulations for historic timber structures and the difficulty to determine in situ the timber species and properties. The available testing and modeling methods require a lot of experience and can be expensive and labour intensive. As consequence, the original timber structure is often replaced or over-consolidated with what is considered a "safer" material (steel or concrete).
This paper aims to increase awareness about the extent, value and nature of seventeenth and eighteenth century timber roofs in Scotland and to understand what their conservation needs are. An initial survey and assessment of 56 buildings across Scotland has allowed identifying different roof structural types, their design, development and their pathologies and possible causes.
Future work will comprise an in-situ testing campaign to further investigate the critical areas identified and to address specific issues and limitations that professionals might encounter during the assessment of these structures. The aim is to develop a method for the initial assessment of timber roofs that can contribute in improving local practice.

2 METHOD

2.1 *A database of seventeenth and eighteenth century buildings in Scotland*

In order to assess the extent, nature and condition of seventeenth and eighteenth century Scottish timber roofs, the first step was to identify Scottish buildings of the period. A database and related mapping has been developed with Microsoft Access and ArcGIS: this tool has been used to locate the buildings and record their history, based on data from the databases of Historic Scotland - now Historic Environment Scotland - (HS 2015), the Royal Commission on Ancient and Historical Monuments of Scotland (RCAHMS 2015) and the Buildings at Risk Register (BARR 2015), as well as literature on Scottish Architecture (Glendinning & Mackechnie 2004). The results from the surveys and archival/historical research are being added to the database as the research progresses; it now includes 1550 buildings.

2.2 *Selection of key buildings*

The database has been used to select key buildings to survey, according to the following criteria:

- designed by architects and of a certain scale;
- no flat roofs;
- major interventions in seventeenth and eighteenth century and no major alterations after 1800;
- key moments in Scottish architectural history;
- roof or wrights' names mentioned in literature or in HS/RCAHMS/BARR;
- original plaster ceilings;
- analysed with dendrochronology;
- owned by HS or NTS (for accessibility);
- in the Scottish central belt (for accessibility);
- designed by Sir W. Bruce, J. Smith or W. Adam, leading architects of the period (Serafini & Gonzalez-Longo 2015, Gonzalez-Longo, 2012, Gonzalez-Longo & Theodossopoulos, 2012).

The owners of 139 buildings have been contacted and 80 of them replied: 66 granted access and 8 informed of the replacement of the roof after 1800 (Fig. 1). Visits to 56 buildings (or groups of buildings, as in Fort George) were eventually arranged (Fig. 2). Of these buildings one had no accessibility to the roof structure and 9 had roofs replaced after 1800. The other 46 buildings/groups of buildings had one or more original roof structures for a total of 76. A building has been considered as having more than one roof structure when these are structurally independent, separated by masonry walls. Thanks to literature references 20 other buildings have been identified as having the roof structure completely replaced after 1800, for a total of 37 (Fig. 1).

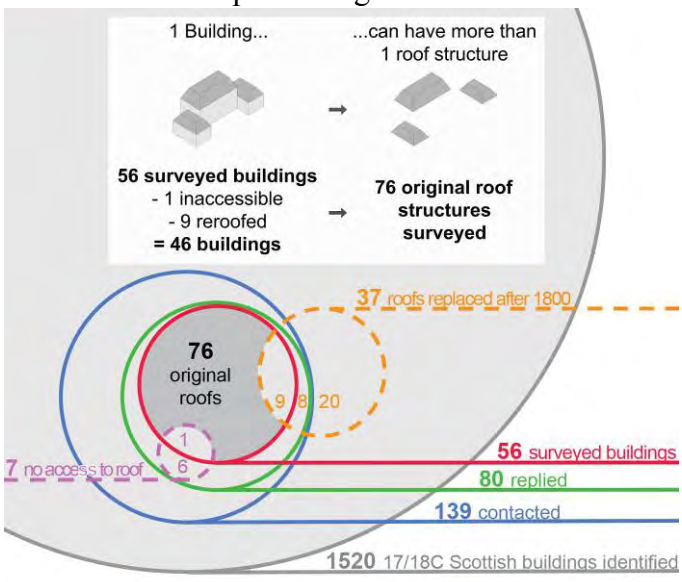


Figure 1. The key buildings' selection process

2.3 *Surveys*

The objective of the surveys was to gain first-hand knowledge on the roofs' construction techniques and typologies and to start assessing their present condition. As suggested in guidelines for the assessment of historic timber structures (Cruz et al 2015), a desk survey was carried out prior to the visits to gather all the necessary information on the buildings, then a preliminary visual and measured survey was done. A tape meter, a laser meter and a digital camera were used. A series of fixed parameters have been recorded during the surveys in order to compare the structures and draw some conclusions from a historical, typological, technological and structural point of view. The parameters recorded include:

- roof form (gabled, hipped, dome, etc);
- roof geometry (span, pitch, length, etc);
- structural arrangements (common rafter roof, purlin roof, etc, as well as the type of frame/truss);
- connection with walls;
- elements' scantlings and section shape;
- timber dressing (hand-axed, hand-sawn, etc);
- joint types and fasteners;
- timber species (if known);
- roofing material and its fasteners;
- carpentry marks;
- evidence for reused timber.

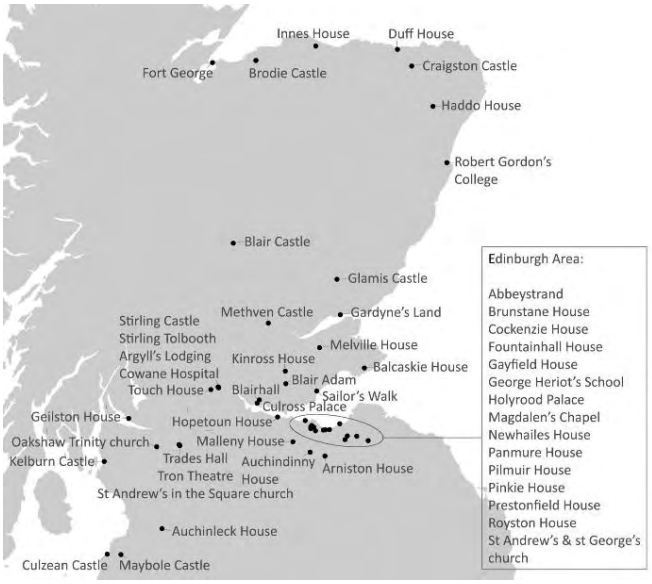


Figure 2. The 56 buildings surveyed across Scotland

Signs of damage have been recorded as follows:
- mechanical damage (deformations, cracks, etc);
- material degradation (fungi/insect attack, etc);
- past interventions;
- unfavorable environmental conditions (poor ventilation, etc) and poor maintenance;

Natural defects (knots, checks, etc) have not been documented at this stage. All the information has been collected in a structured form integrated within the database. The form has been produced in collaboration with COST Action fp1101 and further developed to meet the purposes of this research.
The surveys have helped identifying different structural types and their pathologies, as well as issues in their assessment.

2.4 *Archival Research*

Archives have been searched for information on the surveyed buildings and on wrights of the period. The research has focused on archives in Glasgow and in Edinburgh. The documents consulted include mainly accounts and correspondence that have been used to understand the design and construction processes, the timber procurement, past repair works, the people involved and, in particular, the role of architects and wrights. The study of carpentry manuals of the time (Gomez Sanchez 2006) has helped understanding what knowledge the wrights had access to and if there has been migration of technical knowledge.

3 THE IDENTIFICATION OF STRUCTURAL TYPES AND THEIR DEVELOPMENT

The development of timber roofs' design and construction is closely related to material availability and to the development of the architecture of the period: its layouts, spans and overall composition. The challenge in Scotland at the time was to pass from large spans covered by open purlin structures such as the fifteenth century Darnaway Castle (Stell & Baillie 1993), to large spans covered by shallower roofs carrying heavy plaster ceilings, fashionable from seventeenth century (Fig. 3). Whilst the few remaining Scottish open purlin roofs have been widely investigated, little research has been done on roof structures hidden behind timber and plaster ceilings, which, according to our surveys, cover the vast majority of Scottish buildings throughout the centuries. Hanke (2006) is the only scholar who has previously investigated these roof structures, but he considered mostly documents related to buildings up to 1647 in a restricted geographical area. Newland (2010), Thomson (1991), Crone and Mills (2012) have researched the timber trade of the period.

3.1 *Common rafter roofs*

Before 1500, local Scottish timber was used; oak was considered to be the most valuable, due to its strength and resistance, and used whenever possible for the construction of high status buildings (Newland 2010). From the few remaining roof structures of the period, one can deduce that single pile buildings were covered with gabled roofs whose internal structure was an open purlin roof in case of big spans, and a stone vault in case of reduced spans (Fig. 3). It is not clear when common rafter roofs started being employed. The oldest surviving one could be that of Alloa Tower, first mentioned in 1497 (Ruddock 1995).
In sixteenth century double piles were introduced and common rafter roofs were used with the intermediate spine wall acting as additional support (as in Drochil Castle, Fig. 3). In this period it was hard to find local timber suitable for building construction, due to accessibility problems and low quality: thus oak and pine started being imported from the eastern Baltic, Denmark, Sweden, and Norway soon dominated the market (Newland 2010).
The sixteenth and seventeenth century common rafter roofs we have surveyed (see for example Culross Palace, Fig. 4) are generally simple, composed of rafter couples, spaced 30/60cm, with one or two collar beams, almost square scantlings of 10/15cm, and mortise and tenon or simple lap joints secured with timber pegs. The spans are usually less than 7m, and the pitches are quite steep (50°-60°).
The extensive use in Scotland of very simple common rafter roofs throughout the centuries up to today (Fig. 3) is somehow unusual, considering that in England and Northwest Europe structures started changing already in 13C, when king/queen struts and side purlins were introduced (Hanke 2006). Moreover, Scottish common rafter roofs have some characteristics quite different from the English and European ones, as confirmed by our surveys: they have no tie-beam up to 1700; they never have additional longitudinal bracing other than the sarking (longitudinal timber boards fixed to the rafters and supporting the roof covering); they have no wallplates up to late seventeenth century but sometimes provide additional rigidity through the rafter foot, with the ashlar piece extended downward on the masonry.
As Hanke (2006) suggests, the simplicity and uniformity of Scottish common rafter roofs could be explained by the reliance on imported timber, which seems to have favoured timber structures characterized by few standardised items: deals (timber boards for the sarking) and straight, relatively short beams. According to our surveys, this could be true only up to 1670s, when structures start evolving (Fig. 3).

3.2 *End 17C and 18C: more complex frames*

From 1670s onwards common rafter roofs had to adapt to the new geometries of classical architecture, introduced in Scotland by the architects Sir William Bruce and Mr James Smith. M roofs, hipped and

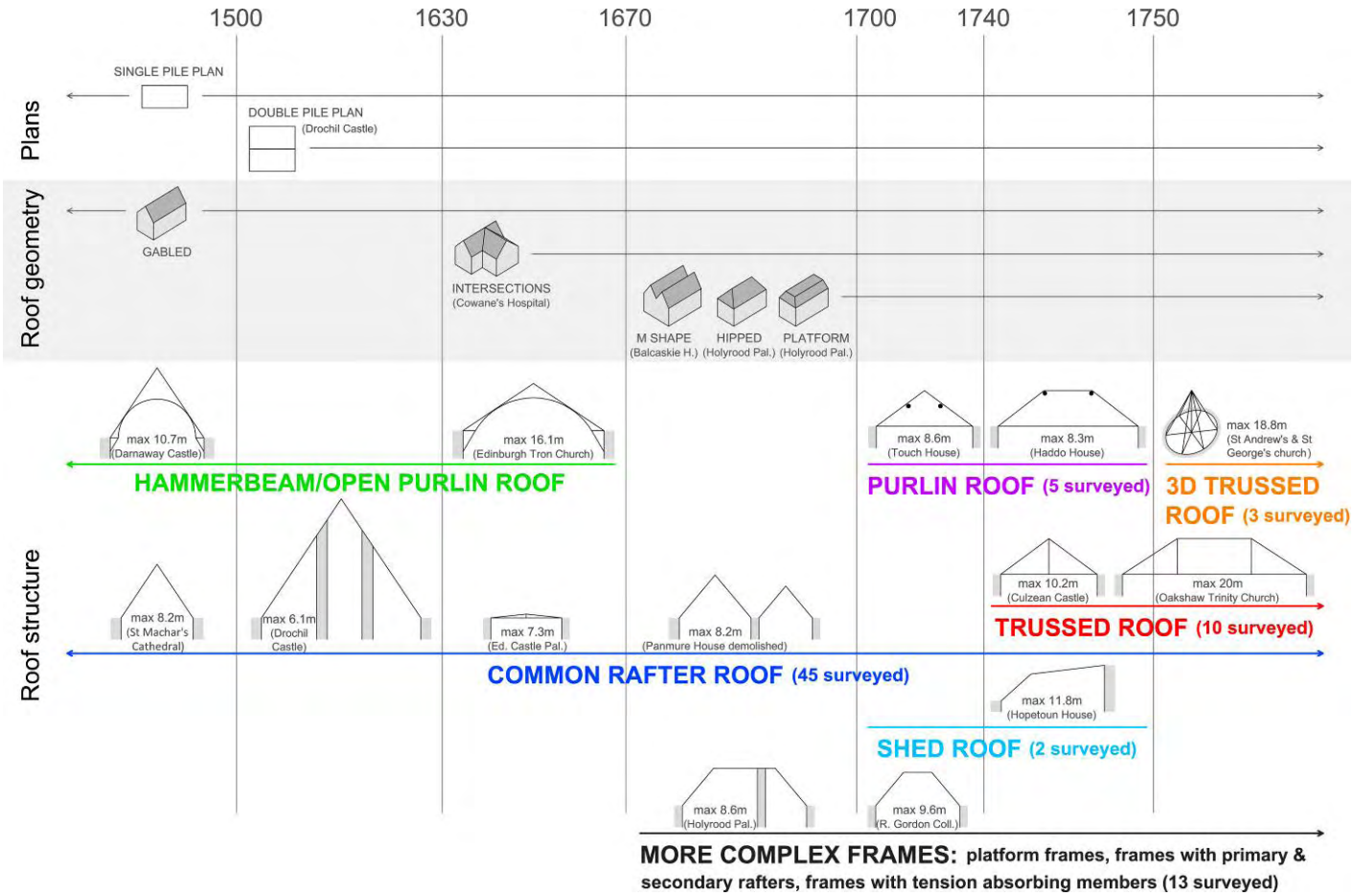


Figure 3. Construction development of Scottish timber roof geometries and structures

platform roofs were introduced (Fig. 3). Wall-plates started being used, as well as tie-beams and tension absorbing joints (dovetail) and members, which shows an understanding of the fact that timber elements can behave in tension too. The internal structure of platform roofs were solved in a quite particular way, as in Melville House (Fig. 4).

Later in eighteenth century the spans increased (up to 9.86m in Duff House 1735), and the pitches became shallower (down to 23° in Yester House 1729, Fig. 4), forcing the internal structures to become more efficient: the elements' sections became more rectangular and butt-purlins were introduced. Rafters started being distinguished into primary and secondary ones, which significantly reduced the amount of timber needed. In Yester House (1729, Fig. 4), for example, primary frames are connected by purlins, which in turn support the common rafters. This arrangement is quite different from those of Culross Palace and Melville House (Fig. 4), where all the rafters and frames are the same, with no distinction between primary and secondary. The 'more complex frames', such as the one at Yester House, seem to have a structural behaviour in-between common rafter roofs and trusses, and could be antecedents of the latter (Serafini & Gonzalez Longo 2015).

3.3 *Purlin roofs*

In eighteenth Norway declined as supplier of timber due to the over-exploitation of its natural resources; its role was taken first by Sweden and then by the eastern Baltic area, exporting balks, to be sawn to meet individual needs, and deals of pine (Thomson 1991). In this period home-grown pine was used as well (Crone & Mills 2012). In the second half of eighteenth century timber was also imported from the Americas, as was happening in England (Yeomans 1992): the West Indies sent exotic hardwoods such as mahogany and American Colonies and Canada provided oak and walnut (Thomson 1991).

The change in the timber trade mirrors changes in construction. Purlin roofs started being employed from late seventeenth century (Fig. 3): Melville House (1697/1703) is the earliest purlin roof we've surveyed (Fig. 4). Unfortunately, the limited number of surveyed examples makes it difficult to draw conclusions on their development. Nevertheless, it is interesting to note that purlin roofs were often coupled with other structural types in the same building, with no apparent reason driving the choice of one structure or the other. This could suggest that either the different timber structures have been constructed in different periods, or, if they appear to belong to the same period (as is the case of Melville House, Fig. 4), that wrights/architects were experimenting.

3.4 *Trusses*

Our surveys suggest that from 1740s/50s king-post trusses started being used to cover reduced spans (Fig. 3), and princess-post trusses and queen-post

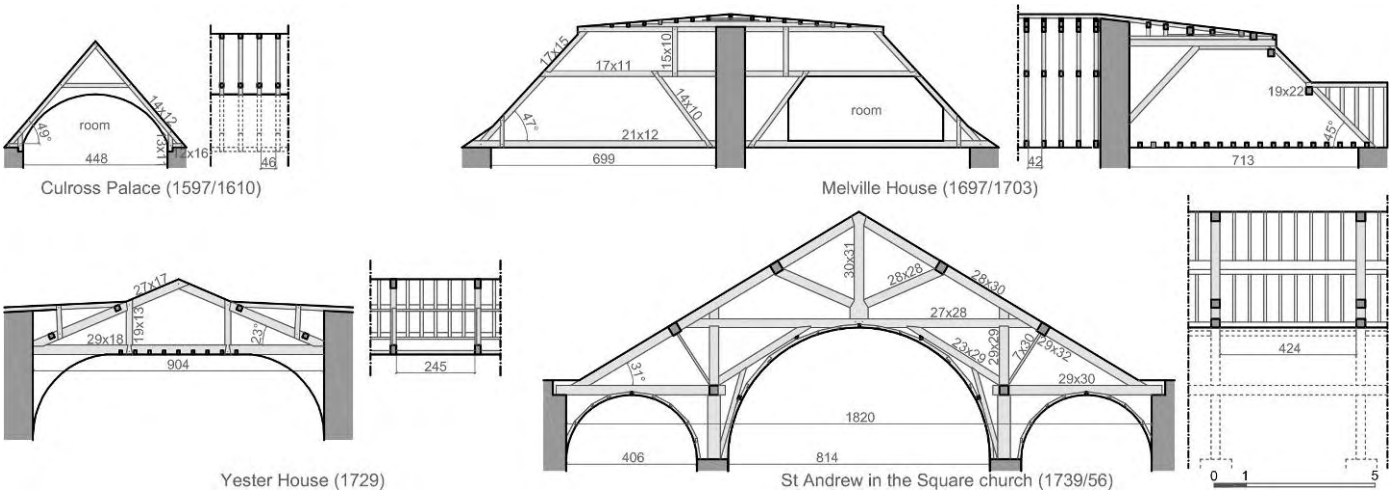


Figure 4. Top left: common rafter roof in Culross Palace (1597/1610); top right: platform frame and purlin roof in Melville House (1697/1703); bottom left: more complex frame in Yester House (1729); bottom right: princess post truss in St Andrew in the Square church (1739/56).

trusses to cover bigger spans (as in St Andrew's in the Square church 1739/56 – Fig. 4). Spans reach their maximum in Oakshaw Trinity church (1754/6) with 20m, and pitches vary between 44° and 27°. The sarking is retained, even though butt-purlins are always used. Joints are all mortice and tenon with no fasteners or timber dowels; scarf joints are very rare. Metal straps are seldom used as well - they are often a later addition. Posts normally have joggles, which could be an English influence (Yeomans 1992), but traces of other influences can be identified too (Serafini & Gonzalez Longo 2015).

It is still not clear how the truss was introduced in Scotland. The arrangements and construction details of the earliest Scottish trusses show little understanding of their structural behaviour. The truss in St Andrew in the Square church (Fig.4), for example, shows an improper design of the joint between the post and the raised tie-beam: it's a simple mortice and tenon joint with no fasteners, which cannot work in tension and counteract the tie-beam deflection. An analysis of drawings and buildings of the Adam architects suggests that although they aspired to build trusses, wrights were initially unable or unwilling to construct them. An external influence was probably necessary for the introduction of trusses in Scotland (Serafini & Gonzalez Longo 2015).

4 PATHOLOGIES AND POSSIBLE CAUSES

4.1 *Assessment of historic timber structures*

The assessment of timber structures can be challenging because of the organic nature of the material and its variable properties.

Recent research has outlined a methodology for the on-site assessment of historic timber structures (Feio & Machado, in press, Cruz et al 2015). They suggest a preliminary assessment based on a desk survey followed by an on-site visual and measured survey, where moisture content readings and Visual Strength Grading (VSG) are carried out. Resistance Microdrilling can be used to assess invisible decay and structural analysis can identify highly stressed areas. The information gathered can then be used in a final structural analysis to verify if the structure complies with the ultimate state requirements. If it fails, a more detailed survey (using other non-destructive/semi-destructive tests – NDT/SDT) must be carried out and the structural analysis updated.

VSG is a powerful method but it has limitations: the subjectivity and low experience of the inspector, limited accessibility, non-visible internal decay, and lack of specific criteria in most national standards. It also requires the timber species identification, which is often not doable (Macchioni 2010). Alternatively, mechanical properties can be estimated with SDT (Kloiber et al, in press) or stress waves methods.

Unfortunately, NDT and SDT also have many drawbacks: poor correlation with material properties; the information obtained is often qualitative/local; the test procedure and the results' interpretation require a lot of experience; it is not clear how to use the collected data; some devices are not on the market yet.

This is why most professionals don't use NDT/SDT but rely mainly on experience, even though this can lead to underestimating the structure's condition and replacing or over strengthening the whole roof.

4.2 *Typical damage in Scottish timber roofs and possible causes*

As explained in section 2, it is known that 17 buildings out of 80 (~20%) have been reroofed after 1800 (mainly in 20C), because thought to be structurally unsafe. 20% is quite a high percentage and suggests either a conservative approach on the professionals' side, leading to the replacement of structures even when not necessary, or poor maintenance on the owners' side, leading to damage/degradation beyond repair. In both cases it is clear that the value of these structures is not recognized and that good conserva-

tion practice is hindered by lack of information, training and method. In order to overcome these limitations, a preliminary visual inspection was carried out to start identifying the typical pathologies and possible causes of the different structural types.

4.2.1 *Poor initial design*

Poor initial design (overall structural arrangement, joints, timber dressing) seems to play a key role in causing damage in all of the roofs surveyed, which is not unusual (Tampone 2007).

Common rafter roofs show joint disconnections/splitting that can be associated with an overall transversal opening of the roof. As already stated, up to about 1670 simple lap or mortise and tenon joints are used, secured with timber pegs. These joints are not capable of resisting tension forces, which the lower collars and rafter feet are subject to. The timber pegs fail easily (also because of biotic attack) and the joints start opening (Fig. 5 left). Even in later roofs, dovetail joints can fail if the timber cracks and splits around the metal nail (Fig. 5 center).

Other common rafter roofs have a problem in the longitudinal direction, with the frames stacking up and losing stability (Fig. 5 right). This seems to happen when the distance between the frames is more than the common 50cm, because the longitudinal rigidity is provided only by the sarking boards.

Trusses with spans below 10m are generally in good conditions, whilst those covering bigger spans sometimes have deflections in rafters and tie-beams, joint disconnections and cracks (Fig. 6), which suggest an



Figure 5. Mechanical damage in common rafter roofs. From left to right: joint disconnection in Sailor's Walk (Kirkcaldy, Fife), joint splitting in Touch House (St Ninians, Stirling), stacking up in Geilston House (Cardross, Argyll and Bute).



Figure 6. Mechanical damage in Trussed roofs. From left to right: joint disconnection in Fort George Ordnance Store (Ardersier, Highland), joint disconnection in Oakshaw Trinity Church (Paisley, Renfrewshire), crack in rafter in Glasgow Trades Hall.



Figure 7. Mechanical damage in purlin roofs. From left to right: deflected purlin in Melville House (Monimail, Fife), deflected purlin in Touch House (St Ninians, Stirling), crack in strut in Touch House (St Ninians, Stirling).

overall deflection and opening of the roof structure. One of the causes is the improper design of arrangements and joints: timber elements are often too long and do not have sufficient propping provided; joints are almost exclusively mortise and tenon secured by timber dowels or nothing, which work only in compression (Fig. 6, left); metals straps are very seldom used and sometimes they are a later addition; scarf joints, when used, are very simple (Fig. 6 center), and again unable to absorb tension forces.
Purlin roofs often have deflected purlins and cracked struts (Fig. 7), caused by insufficient dimensions or lack of supports.
Common rafter roofs also have material degradation problems (fungi, insects, etc), that might be caused, amongst other, by the rough dressing of the timber elements, which often retain some bark and sapwood, more subject to biotic attack (Ridout 1999). Trusses and purlin roofs seem to be less vulnerable, probably because the timber for these bigger and more complex structures was carefully selected to be of high quality, and carefully squared and finished.

4.2.2 *Past interventions*
Past alterations and repairs contributed in creating/accelerating damage in some cases.
Gardyne's Land (end seventeenth century), for example, has deflected collars in the central part of the roof, where a pediment was added in early 18C (Fig. 8 left). Another example is Oakshaw Trinity church, where the heavy plaster ceiling was probably added/replaced in nineteenth century, causing deflections and joint disconnections due to the additional dead load (Fig. 6 center).
There is often no documentation on past repairs and why they have been done. Temporary interventions often become permanent, and their effect on the structure is not monitored. Whilst in eighteenth and nineteenth century timber was used to either replace the whole roof or double its structure (Fig. 8 center), in the twentieth and twenty-first century steel became more fashionable. The weight of steel is often a problem for the masonry and the plaster ceilings. For example, timber posts and steel beams were added in Oakshaw Trinity church to support the hip rafters that were deflecting (Fig. 8 right); this intervention actually increased the loads on the tie-beams, increasing their deflection and joints' opening (Fig. 6 center), and on the masonry, causing cracks. Checks and cracks, with no distinction, are often filled with resin. Checks are natural cracks that develop along the radius of a log, when the timber dries. They rarely are a structural problem. Filling them actually weakens the timber preventing it from 'breathing', and can cause further cracks to develop.

4.2.3 *Inadequate environmental conditions, accessibility issues and poor maintenance*
As already stated, many of the surveyed common rafter roofs suffer from material degradation problems. Besides the timber dressing, other factors probably contribute as causes. Common rafter roofs generally cover dwelling houses, where the lower part of the roof spaces is plastered and occupied by rooms. This part of the structure (and in particular the connection with the wall) is often not visible/accessible, which hinders its maintenance. The upper part is generally quite small, with poor ventilation and sometimes over insulation, and uncovered water tanks that increase humidity. On the other hand trusses are normally employed in public buildings with bigger roof spaces and better ventilation.
The presence of pigeons, wasps, and bats hinders accessibility and maintenance: access to many properties has been denied because of the presence of bats/wasps, and a few of the surveyed roofs proved to be problematic because of pigeons droppings'.
Finally, owners and estate managers do not always know how to access roof spaces and do not have the necessary equipment to do it (ladders, torches, etc).

4.3 *Future work*

Future work will comprise an in-situ testing campaign aiming at complementing the initial analysis carried out through visual inspection. NDT and SDT will be used to further investigate the critical areas identified and to address specific issues and limitations in the assessment of these structures. The intention is to use equipment that is available to professionals in Scotland, in order to develop a method that can contribute in improving local practice.



Figure 8. Past interventions. From left to right: Steel beam and ties counteracting the collars' deflection in Gardyne's Land (Dundee), 18C and 21C timbers strengthening the original 17C timbers in Panmure House (Edinburgh), timber posts/struts and steel beams/straps counteracting the hip rafters' deflection in Oakshaw Trinity church (Paisley).

5 CONCLUSIONS

Seventeenth and eighteenth century Scottish built heritage has not been sufficiently researched. In particular, very little is known about timber roof structures, which are very seldom inspected. This lack of information hinders good conservation practice: the roofs' value is not recognized and their structural behaviour is often misunderstood, resulting in their replacement or over-consolidation.

A relational database and mapping of seventeenth and eighteenth century Scottish buildings has been developed and used to select 56 key buildings to survey. A preliminary assessment based on historical/archival research and visual/measured on-site survey has been carried out. This has allowed identifying different structural types, their design and development, pathologies and possible causes, and issues in their assessment.

Research so far has focused on few medieval open purlin roofs. However, our surveys suggest that the vast majority of Scottish roofs throughout the centuries were common rafter roofs, purlin roofs and trusses, hidden behind timber/plaster ceilings. The apparent simplicity and uniformity of Scottish common rafter roofs could be explained by the reliance on imported timber from Norway, but this could be true only up to 1670s when common rafter roofs evolve and adapt to the new geometries of classical architecture. In eighteenth century wrights and architects start experimenting with purlin roofs and trusses. Considering the limited number of surveyed purlin roofs, it seems that their use remains restricted. Trusses are instead employed from 1740s in the vast majority of public buildings and big country houses, and they are soon used even for reduced spans. However, their arrangements and construction details suggest that their structural behavior was not always understood.

No research has been previously carried out on the present condition of Scottish timber roofs. Our surveys have highlighted how all of the structural types show damage that seems to be caused mainly by poor initial design, but also by past alterations and repairs, poor environmental conditions and poor maintenance. Common rafter roofs seem to suffer of material degradation more than others. In order to assess hidden parts of the structure and verify the hypothesized causes of damage, future work will comprise an in-situ testing campaign, with the aim to contribute in improving local practice.

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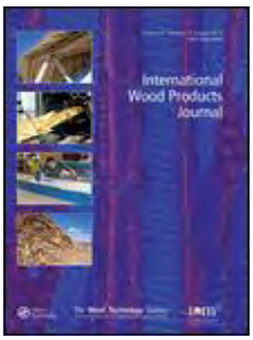
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A. Serafini, M. Riggio & C. González-Longo

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A database model for the analysis and assessment of historic timber roof structures

A. Serafini*[1], M. Riggio[2] and C. González-Longo[1]

Visual inspection assisted by well-structured forms allows experts to collect homogeneous data in order to report about typical damage/vulnerabilities of structures. This is the basis for deriving vulnerability factors to predict failure mechanisms and identify urgent interventions. A database model with an associated structured form for the assessment of historic timber roof structures has been developed during a two-week Short Term Scientific Mission (STSM) in May 2015 at CNR IVALSA Institute in San Michele All'Adige (Italy). The aim is to assist during inspection in recording all the necessary information and later in analysing data from several inspections, allowing to identify typical damage and its causes. The database model, starting from the work of COST Action FP 1101 and further developed and digitalised during the STSM, has been initially populated with data previously collected by the University of Strathclyde through visual assessment of 29 historic timber roofs in Scotland.

Keywords: Timber, Roof, Structures, Historic, Database model, Structured form, Assessment, Diagnosis

Introduction

Visual inspection is the basis of any structural assessment, which is a prerequisite for further analysis, assessment and intervention. Different factors and their interdependency must be considered during the assessment, such as: form, material, loads and environment. The original characteristics and any later alteration/damage must be examined and their causes identified. There are many assessments of single case studies in literature, but their methodology is heterogeneous. The use of structured forms to guide visual inspections can overcome this problem: it provides a uniform approach in the assessment, even when different professionals are involved, thus facilitating comparison of different case studies and identification of vulnerabilities.

Structured forms have been used since 1980s for vulnerability surveys and post-event damage recognition surveys. Benedetti and Petrini's form (1984) was developed to assess the seismic vulnerability of masonry buildings in Italy. More recent research has produced different types of forms to assess seismic damage (Baggio *et al.* 2007), to assess causes of failures in twentieth-century timber roof structures (Frese and Blas 2011; Hansson 2011; Toratti 2011) and to assess the seismic vulnerability of traditional Italian timber roof structures (Parisi *et al.* 2013). In all of these studies the first step was a visual examination of the structures according to a codified procedure: a series of characteristics that determine or influence the specific aspect studied were identified and then a classification criteria was defined to be able to compare different cases, identify urgent interventions and make a plan for risk reduction in the territory.

Toratti's form (2011) was developed with a two-fold purpose: to help the experts in the assessment, making them aware of the relevant questions that need answers; to produce uniform results that can be analysed in order to draw conclusions on typical damage and related causes. The form developed by Task Group 1 (TG1) of Working Group 1 (WG1) of COST Action FP1101 (Riggio *et al.* 2015) had the same purpose but focused on traditional timber roof structures, which had not been addressed so far. Starting from this work a database model and associated form have been developed during a two-week Short Term Scientific Mission (STSM) in May 2015 at CNR IVALSA Institute in San Michele All'Adige (Italy). This paper describes the outcome of this STSM.

The database model and associated structured form

Approach

TG1 identified a series of objectives that the form should fulfil (Riggio *et al.* 2015):

- Allow collecting a significant amount of data reporting typical damage/vulnerabilities;
- Support multi-level analysis (visual inspection, in-situ tests, lab-tests, etc.);
- Define structural types (considering the European built asset) and a damage taxonomy to provide a unified approach to the evaluation of structural damage;

[1]Department of Architecture, Architectural Design and Conservation Research Unit (ADCRU), University of Strathclyde, James Weir Building, Level 3, 75 Montrose street, Glasgow, Lanarkshire, G1 1XJ UK
[2]Wood Science & Engineering, Oregon State University, Corvallis, OR, USA

*Corresponding author, email anna.serafini@strath.ac.uk

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- Distinguish between material degradation and mechanical damage.

Before the STSM the TG1 form was in word format, which did not allow for the analysis of a big amount of data and was not suitable for quick inspections, due to the considerable amount of pages involved. Moreover, a tree-like organisation had been implemented but structure types and damage taxonomy for each level (system, unit, element, connection) had not been clearly identified. The inclusion of Visual Strength Grading (VSG) regulations (such as UNI 2004) had to be defined too, and graphics were needed to support the relevant terminology. Moreover the form needed to be validated by applying it to real case studies. The STSM work focused on the reorganisation of the contents of the TG1 form in both format and structure using Microsoft Access software and data from visual inspections carried out in summer 2014 by ADCRU (Architectural Design and Conservation Research Unit at University of Strathclyde) in 29 timber roof structures in Scotland. The software was chosen because it allows managing and multiple-querying a big amount of data and also because it would allow an easy integration with a mobile phone application being developed in the frame of Working Group 2 of COST Action FP1101 to assist professionals in the selection of interventions on timber roofs (Harte *et al.* 2015).

Since the data available was related to seventeenth- and eighteenth-century timber roofs in Scotland, it was decided to focus on the development a form for the inspection of historic timber roof structures. Once validated, it will be possible to extend the work to the development of a form for other roof structure types and other load-bearing systems.

Content

The aim was to organise the form in order to fulfil a twofold purpose, as in Toratti (2011):

- Assist professionals during inspections in recording and organising all the information needed, pointing out critical aspects that need special attention;
- Assist the analysis of data from several inspections allowing to draw conclusions regarding construction history and typical damage and causes.

The tree-like organisation of the TG1 form has been retained and enriched with a classification of types of structures and damage for each level (Fig. 1). The first part of the form deals with general information on the BUILDING, then each building can have one or more roofs (SYSTEMS), composed of a PRIMARY and a SECONDARY structure; each of these can be composed of UNITS (groups of elements repeated with the same arrangement), and of ELEMENTS and CONNECTIONS between elements.

Each part of the form has a first section on geometrical and typological aspects (Fig. 2), and a second section on damage. Structural types have been grouped into families according to their structural behaviour rather than their geometrical arrangement. Clearly, not all local variations have been considered. Past interventions (alterations, repairs, etc.) can be recorded too. As highlighted by Parisi *et al.* (2013) the effect of past interventions is particularly critical to evaluate, as they can be localised or involve the whole structure, and differently affect the original behaviour/concept of the structure. Thus the form includes only a description and picture/drawing of past interventions, not their evaluation.

Building

General information on the building's name, location, property, protection status, use, interventions, references and geometrical aspects can be recorded in this section. X and Y coordinates and the geo-referencing system have been included in order to be able to plot the results. Values, rather than categories, have been used for seismic, snow and wind loads, and the protection status has been simplified to 'UNESCO', 'National' and 'Regional', to suit every country. Inspections can be linked to each building, specifying: the date, the inspector's name, the parts of the building inspected. Foreseeing the development of forms for the inspection of other load-bearing systems (vertical, floors, foundations), the load-bearing system inspected can be specified too.

Roof

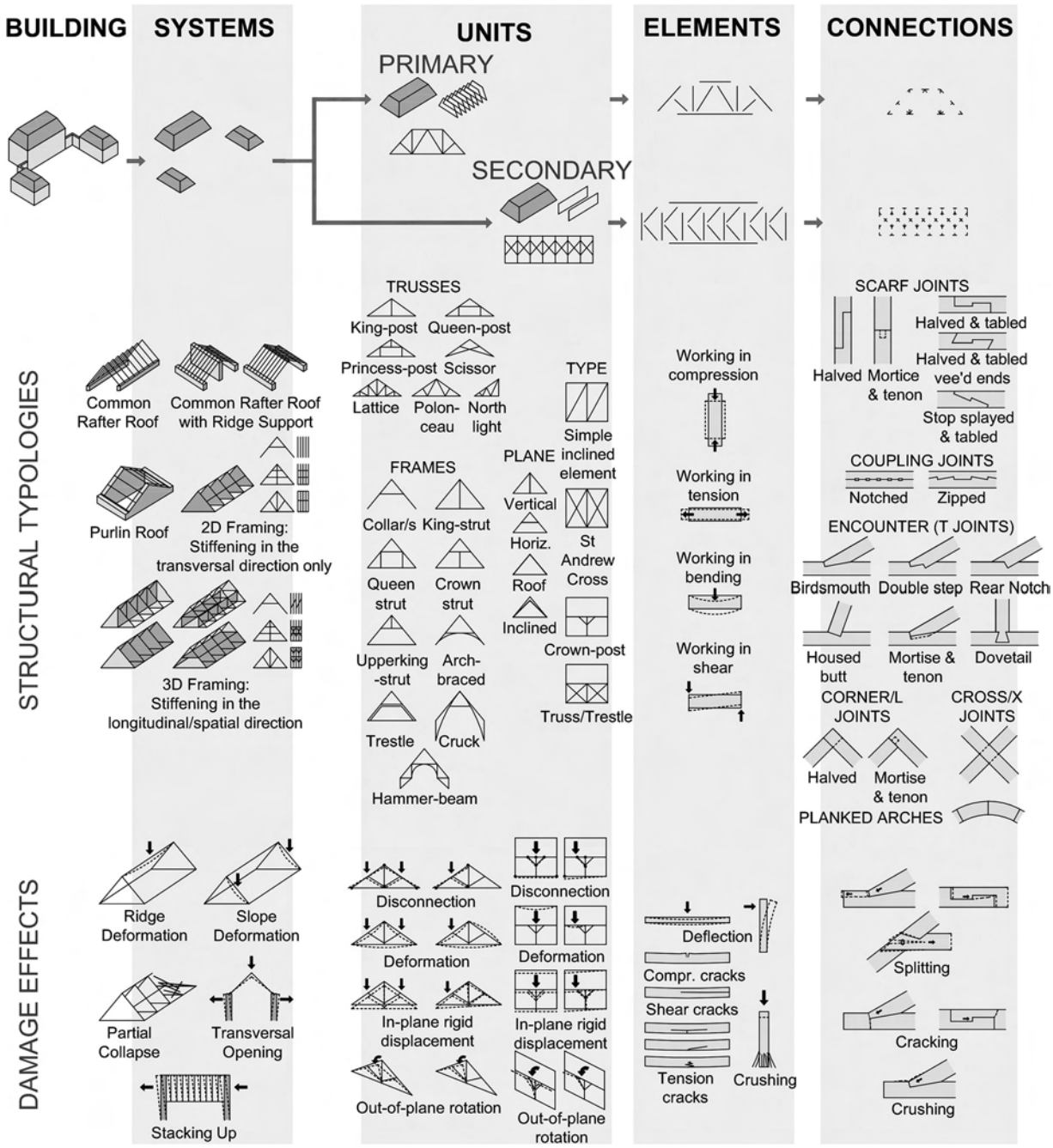
The shape, construction period, roofing material, height, span(s), structure type of each roof can be recorded (Fig. 2). The roof structure can be composed of elements only (common rafter roofs, common rafter roofs with a ridge support, purlin roofs), or units too, in one direction (2D framing), and in two or more directions (3D framing). Other information include if the roof space is in use and if there are accessibility limitations, which can affect the possible interventions. The Eurocode 5 Service Class can be estimated.

Unit

Units have been divided into trusses and frames, as defined by Yeomans (1992, pp. 26–28). It is important to record if the original structural concept is different from the present behaviour: e.g. a unit might have been designed as a king-post truss but is actually behaving as a king-post frame, because of poor design, poor construction, etc. A series of data can be recorded if homogeneous in the whole unit: the timber dressing (rustic or civil, which affects the kind of intervention that can be done), the timber species (grouped in softwoods and hardwoods), the section shape (round, rectangular, rectangular with wanes, trapezoid), the timber treatment, carpentry marks, signs of reused timber.

Element

Elements have been classified as working in compression, in tension, in bending or shear, or a combination of the above (Fig. 1). The dating of the element can be specified, if different from the rest of the unit, as well as all the other information related to the timber dressing, treatment, section shape, etc. Strength affecting defects/natural features (knots, checks, etc.) and material degradation (fungi attack, insect attack, metal corrosion) have been included in this part only, as they cannot be homogeneous for a whole unit or roof. Since most countries have regulations for VSG of new timber but not for VSG of in-situ historic timber, it was decided to include only the natural defects that can significantly alter the structural behaviour or reduce the strength of an element: the position of the pith, the slope of grain, knots in the tensile area and horizontal deep checks which alter the section inertia. The



1 The tree-like organisation of the form, with structural types and damage effects

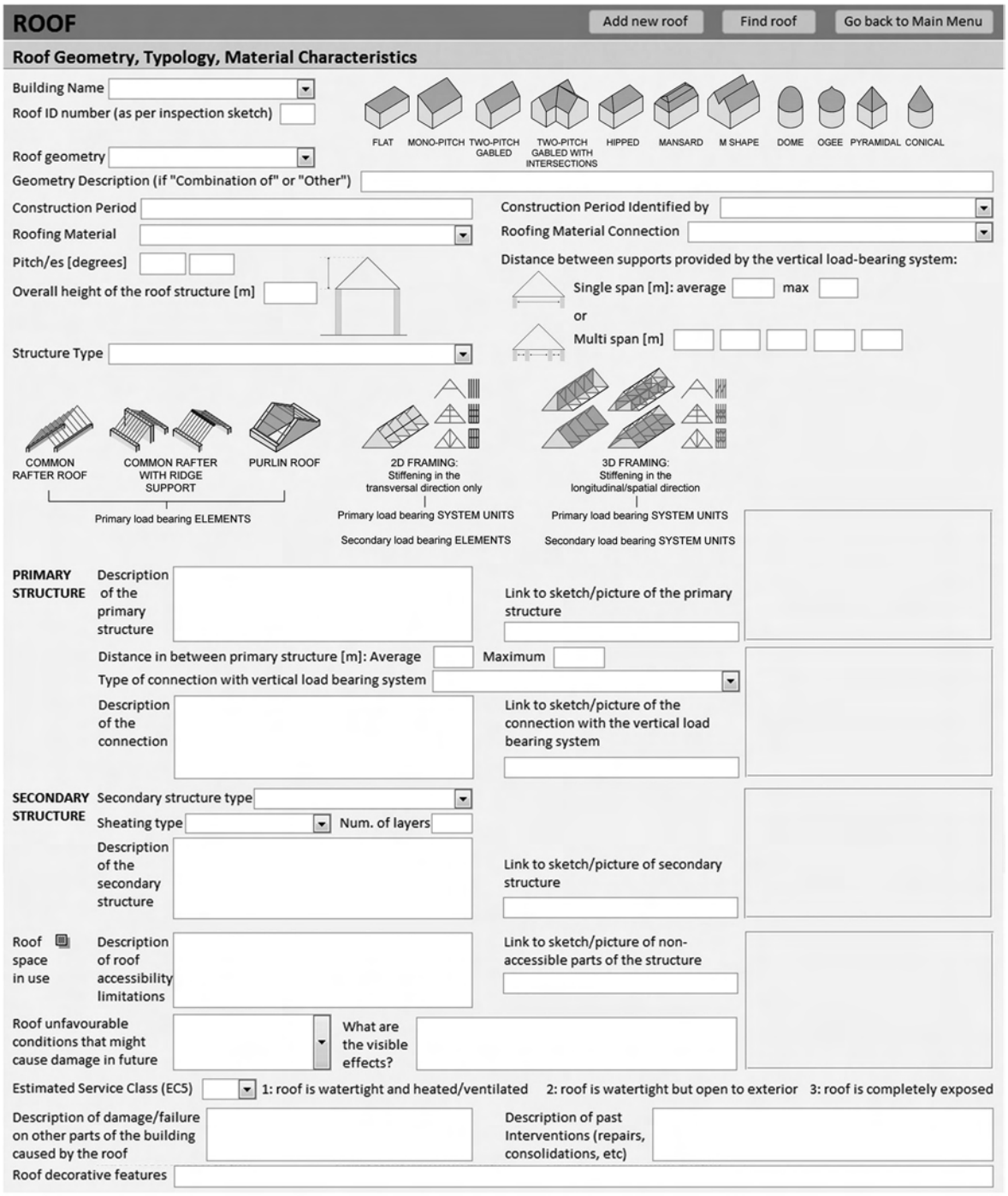
type, extent and status of material degradation can be estimated.

Connections and secondary structure

The part on connections and secondary structure is organised in the same way, the only difference being the types of connections, bracing systems and damage (Fig. 1).

Damage

An important distinction has been made between damage effects and causes. During an assessment, we record the visible effects of damage and estimate their causes. The form guides the inspector in doing that: lists of damage effects (deformations, displacements, rotations, cracks, etc.) are suggested for each level (system, unit, element, connection), and for each of the effects selected the damage status and role can be estimated. Tampone's work (1996, 2016) was very useful to build the damage taxonomy (Fig. 1), as well as the work of Task Group 3 of WG1 of COST Action FP 1101 on traditional carpentry joints (Sobra *et al.* 2015). Regarding the status, a damage can be 'active' or 'non-active', but it is not always possible to judge. Therefore, a simple 'intervened on' can be chosen, meaning that an intervention has been done to repair the damage but no evaluation on its effectiveness is given. Regarding the role, a structure is often affected by a sequence of damage rather than a single one, and it is important to identify the first one that caused all the others. This first one is defined as 'primary' damage, while all the others are defined as 'secondary' ones.



DROP-DOWN MENUS:
- Building Name: any building included in the 'building form' will appear in the list
- Roof Geometry: flat, mono-pitch, two-pitch gabled, two-pitch gabled with intersections, hipped, mansard, m shape, dome, ogee, pyramidal, conical, combination of, other (as in graphic legend)
- Construction period identified by: estimated, reported, dendrochronology
- Roofing material: slates, timber shingles, copper plates, lead plates, tiles, thatch, other, unknown
- Roofing material connection: timber pegs, metal nails, other, none, unknown
- Structure type: common rafter, common rafter with ridge support, purlins, 2D framing, 3D framing, other (as in graphic legend)
- Type of connection with vertical load bearing system: timber wall-plate, steel wall-plate, reinforced concrete wall-plate, reinforced masonry wall-plate, timber discontinuous, steel discontinuous, other, none, unknown
- Secondary structure type: sheating, purlins, common rafters, bracing, other
- Roof unfavorable conditions that might cause damage in future: poor design, poor construction, poor maintenance, poor ventilation, presence of pigeons/wasps/bats
- Estimated Service Class (EC5): 1, 2, 3

2 Form screenshot (section related to roof geometry, typology and material characteristics) with list of terms included in the drop-down menus

The causes of primary damage have been grouped in:

- Poor design (insufficient dimensions, inefficient joints, inefficient overall arrangement);
- Poor construction (poor material quality, poor seasoning, poor treatment, poor detailing, alterations of design);
- Material degradation (fungi attack, insect attack, metal corrosion);
- Poor maintenance;
- Interventions (increase of dead loads, repair/consolidations);
- Extreme actions (wind, fire, earthquake, snow, impact loads, settlements).

The specific type of causes vary in each part (roof, unit, element, connection) but the groups remain the same. The forms previously discussed (Frese and Blas 2011; Hansson 2011; Toratti 2011) have helped in defining the possible causes of damage.

Poor design, poor construction and all the other, can also be recorded as potential causes of damage, called 'unfavourable conditions'. This means they have not caused damage yet but might be a problem in the future, which is why they should be recorded nonetheless. Other unfavourable conditions have been included too, such as poor ventilation and the presence of bats/wasps/pigeons.

While the geometrical/typological aspects remain the same, damage can change in time, and its evolution and development must be recorded. Thus the date of inspection has been included in the damage part.

Form

A main menu and linked forms have been created, to allow for an easier use and visualisation of the form. Instructions have been included in the main menu, explaining how the form is organised and the nomenclature used.

Drop-down menus with fixed lists have been included to help users in both filling the data, as they give suggestions, and in analysing it afterwards, as data filled in as free text is always less homogeneous and less easily searchable (Fig. 2). Items can be added to the drop-down lists and more than one choice can be selected where appropriate. 'Other' and 'unknown' have been included as choices in every drop-down menu, to not force users in choosing something that does not match their judgment. The possibility of adding descriptions and pictures/sketches has also been provided.

The form is suitable for both quick and more thorough assessments. Some fields have been repeated (such as the timber dressing, the timber species, etc.) at different levels, so that if they are homogeneous for the whole roof, or a whole unit, they do not need to be repeated for each element. Moreover, while providing space for all the information that one might want to record, all the fields have been left as 'non-required', so that they can be left blank: only the information that is available and useful for the specific purpose of that inspection should be recorded. Data can be changed and added any time later on.

There are many terminology issues, as types of roof structures, elements and connections have different names in different countries, and even the terminology associated to different damage/failures types is not always clear for English-as-a-second-language speakers. It was decided to solve this problem with drawings/sketches, which work as legends for the drop-down menus and other terms that might be misinterpreted (Fig. 2). Many terminology issues remain though: a work on terminology is a complex and long activity that was outside the scope of this work.

Future developments

The database model and form were presented and discussed at the COST Action FP 1101 meeting held in Trondheim, Norway, on 18th/19th June 2015, and at the COST Action FP 1101 final conference in Wroclaw, 8th September 2015. The feedback received was used to revise it. The form has been distributed among TG1 members for further revision and validation. There is also the possibility of it being implemented in an online version, in collaboration with a research group who has developed a semantic database model for the assessment and diagnosis of historic structures (Cacciotti *et al.* 2015).

Future developments include extending the methodology to the development of forms for other load-bearing systems, incorporating data also from non-destructive/minor-destructive testing in order to quantify the damage in addition to characterising it.

The data collected through the form could also be useful to associate each type of damage with the most suitable repair intervention (Harte *et al.* 2015).

Conclusions

A database model and associated form for the assessment of historic timber roof structures has been developed based on the work of COST Action FP1101 and ADCRU at the University of Strathclyde. The aim is to guide visual inspection through a structured digital form, collecting a relevant amount of homogeneous data recording and reporting typical damage/vulnerabilities of structures. This is the basis for deriving vulnerability factors to predict failure mechanisms and identify urgent interventions. The development of this data collection and analysis procedure will support professional practice and increase knowledge on existing timber structures. Once validated, the approach used (the tree-like organisation of the form, the flexibility for its use in both quick and in-depth inspections, the graphics explaining the relevant terminology, etc.) could be applied to develop forms for the analysis and assessment of other structural systems.

ORCiD

A. Serafini http://orcid.org/0000-0001-7547-4639

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